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FLINT HILLS resources

MANAGEMENT OF CHANGE FORM

(REFER TO PROCEDURE EHS-I-006 FOR EXPLANATION OF THIS FORM)

PROCESS UNIT/AREA: TD LAB (New Control Room)　　MOC#: 150494

ORIGINATOR: J.Cacciatori　　DATE: 01/22/2013

SECTION A - TECHNICAL BASIS FOR PROPOSED CHANGE

Purpose and Technical Basis:	Part of Facility Siting Project. Facility Siting Study done by Baker Risk in 2010 identified the pilot plant control room as a BDL 4 area, which necessitates moving the operators station (control room) out of the area.
Description: *Attach additional paper if necessary*	Install new 12' x 40' Control Room for TD Lab as per the attachments * See Structural Drawing Attachment (Meece Eng. DWG's) * See Building Detail Attachment (Hunter DWG's)
Impact of change On Environmental Health / Safety:	Attached is copy of Baker Risk Siting Study as well as PHA. Will address issues identified in the facility siting study by relocating the operators station to a safe area.

SECTION B - DOCUMENTATION - *Attach appropriate documentation illustrating proposed changes*

☐	Procedures	☐	Inspections, Testing, PM's	☐	Engineering DWGS	☒	PHA'S
☐	PSM Documentation	☐	CHEMGEMS Specifications	☒	P&ID's	☐	MI Applicability Checklist
☐	MSDS Information	☐	Energy Control Plans	☐	PFD's		
☐	Training/Communication	☒	Floor Plans	☐	LDAR		
☐	Quality Issues	☐	Mechanical Integrity DWGS	☒	Site/Plot Plan		
☐	Customer Impact	☒	Electrical Schematics	☒	Electrical Single Lines		
☐	Alarm Response Tables	☐	Loop DWGS	☐	Elect'l Classification		
☐	Other	☐	JSA's	☐	OJT's		

Affected Personnel Needing To Be Informed/Trained On Proposed Change

☒	Operations	☒	I/E Technicians	☐	Community
☒	Production Facilitators	☐	Engineering	☐	Regulatory Entities
☒	Mechanics/Welders	☐	Contractor(s)	☐	Corporate
☒	Electricians	☐	Office Personnel	☐	Other

SECTION C - Is Change Permanent?

☒	**YES**	**Proposed Project Start Date 01/25/2013**
☐	**NO**	**Proposed Project Completion Date 07/31/2013**

SECTION D - Is Change Temporary ?

☐	**YES**	**From:**
☒	**NO**	**To:**

SECTION E - Is Change Emergency ?

☐	**Yes**	
☒	**NO**	**Start:**

Approval Received From:

☐ Area Mgr./Designee　☐ Env. Mgr. /Designee

☐ Plant Mgr./Designee (if requested)　☐ Engineering/Maint. Mgr./Designee

☐ H&S Mgr/Designee

Approval Received By:

Signature　*Date*

Returned To Original Service: ____/____/____

Area Manager/Designee Signature:

Extended To: ____/____/____ *

Plant Managers Approval:

Plant Mgr./

Signature　*Date*

*Note: Temporary MOCAs may be extended up to 6 months at a time

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SECTION F - DESIGN SAFETY REVIEW

	YES	NO
PHA. Does the proposed change require a PHA? (i.e. What-if/Checklist, Hazop, Revalidation, Review) If yes indicate type of PHA in Action to be Taken section.	☒	☐
PSSR. Does the proposed change require a Pre-Start-up Safety Review (PSSR)? See EHS-I-067 for Requirements. Mandatory if change involves DCS Interface.	☒	☐

1. RELIEF AND BLOWDOWN

Does the Proposed Change:	YES	NO
1. Introduce or alter any potential cause of over/under pressurizing of the system?	☐	☒
2. In any way affect existing equipment installed to prevent over/under pressurization?	☐	☒
3. Introduce or alter any potential cause of raising/lowering the system temperature?	☐	☒
4. Introduce a risk of creating/reducing vacuum in the system?	☐	☒
5. Have any critical relief devices been identified for verification of proper rating and installation?	☐	☒

2. AREA CLASSIFICATION

Does the Proposed Change:	YES	NO
1. Introduce or alter the storage of flammable materials?	☐	☒
2. Introduce or alter the location of potential leaks of flammable materials?	☐	☒
3. Introduce new or alter existing electrical equipment?	☒	☐
4. Affect area ventilation?	☐	☒
5. Has the established building electrical classification been changed?	☐	☒

3. SAFETY CONSIDERATIONS

Does the Proposed Change:	YES	NO
1. Require any additional safety equipment or layers of protection?	☐	☒
2. Alter or affect existing safety equipment or means of egress?	☐	☒
3. Require changes to the function or independence of existing equipment or layers of protection?	☐	☒
4. Alter or affect critical safety instrumented functions (SIF's)?	☐	☒
5. Alter the noise level in the surrounding area?	☐	☒
6. Increase the potential for exposure to any chemicals?	☐	☒
7. Introduce a new or previously unused chemical/raw material?	☐	☒
8. Affect de-energization? (able to lock-out, drain materials)	☐	☒
9. Create any ergonomic concerns?	☐	☒
10. Affect the Battery Limit Valves (BLV)?	☐	☒
11. Affect the overall security of the facility?	☐	☒
12. Does this increase the risk of potential impact to plant personnel (employees and contractors)?	☐	☒
13. Does the proposed change affect facility siting relative to both people and equipment in any of the following situations: temporary changes , before startup after a permanent change, or before startup after temporary change has been removed/closed/returned to original condition?	☐	☒
14. If the proposed change affects replacement or demolition of piping or conduit, will the entire run be identified and clearly marked prior to work, to ensure safe work activity?	☐	☒
15. Affect the safe transport of hazardous material? For ex., introducing a new hazardous material for transport or changing the method of transportation of the hazardous material.	☐	☒

4. ENVIRONMENTAL AND QUALITY CONSIDERATIONS

Does the Proposed Change:	YES	NO
1. Alter the composition or amount of a process water?	☐	☒
2. Increase the emissions of any regulated pollutant?	☐	☒
3. Require a new or modified operating/construction permit?	☒	☐
4. Affect the control of the process?	☐	☒
5. Affect the composition or physical properties of the final product?	☐	☒
6. Impact any Pentane/Styrene components in the Leak Detection and Repair (LDAR) Program?	☐	☒
7. Increase risk of off-site residential & environmental receptors?	☐	☒
8. Introduce new materials/chemicals to the site?	☐	☒
9. Does an evaluation of chemical compatibility need to be conducted?	☐	☒
10. Involve decommissioning/demolition of equipment or structures?	☐	☒
11. If answered YES to question 10, do NESHAP or decontamination requirements apply? **	☐	☒
12. Will this change require portable engines to be brought on to FHR property?	☐	☒

** Consult with Environmental Engineer for completion of this question.

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SECTION F - DESIGN SAFETY REVIEW -- cont.

5. OPERATION AND DESIGN

Does the Proposed Change:	YES	NO
1. Affect the process or equipment upstream/downstream of the change?	☐	☒
2. Affect access to process or equipment/controls for personnel?	☐	☒
3. Introduce any new or affect existing interlocks or alarms systems?	☐	☒
4. Affect manpower or qualified personnel?	☐	☒
5. Affect the loads/strengths of existing foundations, structures, vessels, or pipe racks?	☐	☒
6. Impact requirements of existing or proposed piping supports? *(Needs to be adequately designed for expected stresses due to pressure and thermal loadings.)*	☐	☒
7. Alter the DCS/Software logic of process operations?	☒	☐
8. Affect process chemistry? (reactivity/compatibility)	☐	☒
9. Affect maximum intended inventory, that would require updating maximum inventory tables?	☐	☒
10. Affect safe upper/lower limits for such items as temperature, process flows or compositions?	☐	☒
11. Affect material/energy balances?	☐	☒
12. Affect plant utility resources? (i.e. steam, water, electricity, etc.)	☐	☒
13. Affect equipment with heat-up/cool-down cycling requiring bolt retightening after start-up?	☐	☒
14. Is an exception/revision to design codes or standards (CHEM-GEMS, etc.) required?	☐	☒

SECTION G - AFFECTS ON PROCEDURES, TRAINING, AND DOCUMENTATION

Will the Proposed Change:	YES	NO
1. Introduce new or impact existing operational procedures? *	☒	☐
2. Introduce new or impact existing maintenance procedures? *	☒	☐
3. Add or Remove equipment/instrumentation? *(Contact ETA to assign Equipment/Instrumentation Location Numbers. If equipment/instrumentation is being added, MI Applicability Checklist MNT-F-161 shall be completed by MOC originator, and approval form(s) sent to the MI coordinator.)*	☒	☐
4. Revise equipment preventative maintenance/ inspections, job plans , and/or frequencies?	☐	☒
5. Require additional training for operational or maintenance personnel? *(requires completion of Leaning and Development Job Aid addendum A))*	☐	☒
6. Require additional notification for operational or maintenance personnel?	☒	☐
7. Require updating controlled drawings? * *(PFD'S, LDAR, P&ID's, Floor Plans, Electrical Single Lines, Loop Drawings/Electrical Schematics, MCC arrangement, MI Iso Drawings)*	☒	☐
8. Require updating equipment files? *(Engineering, Maintenance, Manufacturers Inspect/Test results)*	☒	☐
9. Require a spare parts list and inventory to be developed?	☐	☒
10. Require major project spare equipment to be turned over to maintenance?	☐	☒
11. Require equipment labeling in the field?	☒	☐
12. Require updating of Alarm Response Tables? *	☐	☒
13. Require a new/modification of existing energy control plans? *	☐	☒
14. Cause any PSM/RMP applicability issues?	☐	☒
15. Cause a change in PSM/RMP program level?	☐	☒
16. Will this change have any effect on the overall plant facility siting issues?	☒	☐
17. Increase or decrease the impact contour for worst-case scenario by a factor of two or more?	☐	☒
18. Will this MOC supersede /interfere with any other Temporary/Emergency/Permanent MOC's?	☐	☒
19. Is there a need to update the EPS-I-004, Chemical Compatibility Matrix?	☐	☒
20. Is a Layer of Protection Analysis (LOPA) study required?	☐	☒
21. Will this affect the Interlock Matrix?	☐	☒
22. Require updating of electrical energy consumption spreadsheet? Update required for any MCC, CB panel or bus bar connection additions or alterations.	☒	☐
23. Will this change impact Proprietary Technology including product, process, equipment, technical data, or other trade secret information licensed to FHR by third parties" If yes, contact the Proprietary Technology Coordinator.	☐	☒

*** NOTE: Refer to Engineering Equipment Location Database for a list of affected documents, sorted by Location Number.**

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Any questions with a 'YES' answer, requires follow-up activity. List the action(s) to be taken to resolve any issues identified in 'Section F' and 'Section G'			
Item No.	**Action To Be Taken**	**Responsible Party**	**Target Completion Date**
F.PHA	Perform PHA - Facility Siting Checklist	J.Cacciatori	07/31/2013
F.PSSR	Perform PSSR	J.Cacciatori	07/31/2013
F2.3	Install new conduit runs to new control room	J.Cacciatori	07/31/2013
F4.3	Obtain new construction permit	J.Cacciatori	03/31/2013
F5.7	Complete and Implement DCS logics to new control room	K.Marshall	07/31/2013
G.1	Update operational procedures as necessary	R.Leckonby	07/31/2013
G.2	Update maintenance procedures as necessary	J.Vittone	07/31/2013
G.3	Update MI equipment list as necessary	D.Tostovarsnik	07/31/2013
G.6A G.6B	Notify Operators Notify Maintenance & electricians	R.Leckonby J.Vittone	07/31/2013
G.7	Update Drawings	L.Grant	07/31/2013
G.8	Update Equipment Files	B.Christmann	07/31/2013
G.11	Label Equipment in Field	J.Cacciatori	07/31/2013
G.16	Project will reduce facility siting risk by reducing number of employees in TD Lab structure. Complete relocation of control room.	J.Cacciatori	07/31/2013
G.22	Update Electrical Spreadsheet	L.Grant	07/31/2013
~~PHA.1~~	No traffic issues in Pilot Plant control room area. MTS ~~Change traffic routes for large vehicles~~	~~M.Steinbach~~	~~07/31/2013~~
~~PHA.2~~	~~Add fencing near Pilot Plant Building~~	~~J.Cacciatori~~	~~07/31/2013~~
~~PHA.3~~	~~Update Emergency / Evacuation Plans~~	E. Skoog MTS ~~M.Steinbach~~	~~07/31/2013~~
~~PHA.4~~	~~Pressurization of new control room (Tracy Clem)~~	~~M.Steinbach~~	~~07/31/2013~~
PHA-1	Enter PHA & Action Items in Lynx	C. Cacciatore	2/28/13
	PHA to be entered in Lynx to avoid duplicate action items.	MTS	

FHRPRU001632

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MOC APPROVAL FORM

Originator: J. Cacciatori **MOC No.** 150494

MOC Packet Completeness Verification Review

Title/Position	Verification Review Signatures	Date
Drafting Tech, or Designee	[signature]	1-23-13
MI Coordinator, or Designee	[signature]	1-23-13
Maintenance Tech from appropriate area	[signature]	1.23.13
Operator from affected area	Chad Rielinki	1/23/13
Area Training Contact, or Designee	Roy A Leckonby	1/24/13

Signatures required Prior To Implementation of MOC

Title/Position	Authorizing Signatures	Date
Area Manager, or Designee (Operations Representative Assignee: ______)	Roy A Leckonby	1/24/13
Engineering /Maintenance Manager or Designee (Electrical Engineering Review: Steve Pawlak)	[signature] [signature]	1/24/13 1/24/13
Health and Safety Manager or Designee (PSM Coordinator Review ______)	Mary Steinbach	2/6/13
Operations Manager or Designee	[signature]	2-7-13
Environment Manager or Designee	[signature]	2/6/2013

Plant Managers Review
(as requested by any of the Authorizing signers)

Title/Position	Review Signature	Date
Plant Manager or Designee		

VERIFICATION OF MOC CLOSURE

By signing below:

1. The Originator of this MOC confirms that all action items have been completed & that equipment/documentation in this change is set to start up.
2. The Engineering/Maintenance Manager has completed and attached the MOC – Closure Checklist.

MOC closure requires the Originators Signature, and that of the Engineering/Maintenance Manager

MOC Originator: Date:__________

Engineering/ Maintenance Manager: Date:__________

MANAGEMENT OF CHANGE - CLOSURE CHECKLIST

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This Form **MUST BE** completed by the Engineering/Maintenance Manager, and attached to MOC Prior to MOC Being Closed By ETA

Originator: J. Cacciatori   MOC No. 150494

1. What Type of Management of Change?
   - [ ] Permanent MOC
   - [ ] Emergency MOC
     Returned to Original Service? [ ] YES [ ] NO
   - [ ] Temporary MOC
     Returned to Original Service? [ ] YES [ ] NO

2. PHA. completed. (HAZOP, Safety Review, Independent Review)
   - [ ] YES
   - [ ] NO
   - [ ] N/A

3. Documentation included in file or referenced, which verifies affected change has been communicated to all effected parties?
   - [ ] YES
   - [ ] NO
   - [ ] N/A

4. Documentation illustrating changes included in MOC package? *(marked-up drawings, etc.)*
   - [ ] YES
   - [ ] NO
   - [ ] N/A

5. Referenced Drawings Updated?
   - [ ] YES
   - [ ] NO
   - [ ] N/A

6. All applicable documentation has been updated to reflect changes?
   - [ ] YES
   - [ ] NO
   - [ ] N/A

7. All training has been completed.
   - [ ] YES
   - [ ] NO
   - [ ] N/A

'Management of Change' Audited By:

Title: ______________________

Signature: ______________________   **Date:** ______________

FHR FACILITY SITING CHECKLIST

Note that the FHR Facility Siting Checklist questions may be entered into the PHA software.

1. All the questions shall be considered and evaluated by the PHA Team.
2. If no significant hazard was identified:
   a. The appropriate response (Y / N / N/A) should be indicated in the Response column.
   b. Any appropriate notes or comments should be recorded in the Comments column. *Because there was no Identified Hazard (Finding), there would be no need to record existing safeguards or risk rank the hazard, although the safeguards may be recorded if discussed and captured during the review.*
3. If a potential hazard was identified:
   a. The appropriate response should be indicated in the Response column.
   b. The Identified Hazard (Finding) should be recorded in the Comments column.
   c. Determine if the hazard has already been addressed within the HAZOP nodes or other checklist question. If so, document that the hazard has been addressed and reference where in the Comments column (note that reference to a specific nodes may not be needed or practical). If not, continue.
   d. The current/existing safeguards should be recorded in the Comments column.
   e. The PHA Team should qualitatively assess the potential consequences and likelihood against the existing safeguards to determine the risk using FHR's risk matrix. *The general nature of the questions makes it more difficult to evaluate and characterize the potential consequences and likelihood. Because this is a qualitative assessment it is not necessary or possible to be exact or precise. The PHA Team should strive to reach consensus on a reasonable consequence and likelihood based on their experience and expertise. Additional experts may be called upon to help reach consensus. A more detail assessment may be recommended if warranted by the potential risks.*
   f. If no residual risk exists for the Identified Hazard, then a note should be added to indicate existing safeguards are considered adequate.
   g. If a residual risk exists for the Identified Hazard, or the risk could not be properly evaluated with the existing information, the Identified Hazard should be marked as a Finding that requires additional evaluation and potential risk reduction.

Siting checklist completed for new control rooms installation @ Peru facility.

Question	Response (Y / N / N/A)	Comments
A. UNIT LAYOUT (SPACING BETWEEN PROCESS COMPONENTS) AND LOCATION OF UNIT / FACILITY RELATIVE TO NEIGHBORS		
1. Has there been any new construction in the areas around the facility that might change the RMP off-site consequences (new public receptors)?	No	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Are operating units and the equipment within units spaced to minimize potential damage from fires or explosions in adjacent areas? Are vessels containing highly hazardous chemicals located sufficiently far apart? *If not, what significant process hazards are introduced?* Are the ends of horizontal vessels facing away from personnel areas, occupied buildings, control rooms, and critical equipment? Can adjacent equipment or facilities withstand the overpressure generated by potential explosions *(reference facility siting study)*? Can adjacent equipment and facilities (e.g., support structures) withstand flame impingement or radiant heat exposures?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Are large inventories or release points for highly hazardous chemicals located away from public access roads and vehicular traffic within the plant? When provisions have been made for relieving explosions in process components, are the vents directed to a safe location away from personnel and critical equipment?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Are HHC handling equipment located outdoors? Where indoors, are there adequate safeguards to protect people working in and around the buildings or structures?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
5. Do vents, drains, sewers, and relief valves discharge to safe locations? Consider proximity to heat sources, open flame, furnaces, buildings, shelters, evacuation routes, walkways, roads, pressure vessels, piping, pipe racks, chemical storage, cylinders, bottles, totes, and HHC inventories. For atmospheric vents, are flammable materials, liquids and gases, in relief discharge equipment (e.g. longer discharge piping, atmospheric stacks, blowdowns, etc.) handled safely (i.e., vented or drained to safe locations)? NEP Compliance Guidance from CPL 03-00-010 concerning relief devices that discharge to atmosphere: ▪ Are there negative affects on employees or other equipment that could cause another release ("domino effects") of hazardous materials/HHC? ▪ What presumptions or assessments exist to support that there will be no negative effects of an atmospheric release of hazardous materials/HCC? ▪ Are employees near where relief devices discharge, including downwind locations (e.g., on the ground, on platforms on pressure vessels in the vicinity of elevated relief devices, etc.)? ▪ Could a release from a relief device cause a release from other equipment, or could other nearby equipment affect the release material (e.g., a furnace stack could be an ignition source if it is located proximate to an elevated relief device that is designed to relieve flammable materials)? Part of the employer's PHA team's evaluation, after it identifies the locations of open vents, is to determine if employees might be exposed when hazardous materials are relieved. If the PHA team concludes that a current and appropriate evaluation (such as the use of dispersion modeling) has been conducted, the evaluation could find that the vessels/vents relieve to a safe location. If the PHA team determines that this hazard has not been appropriately evaluated, the PHA team must request that such an evaluation be conducted, or make some other appropriate recommendation to ensure that the identified hazard/deviation is adequately addressed.	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
6. Are workers in adjacent units protected from all of the following, and are workers in this unit protected from the effects of adjacent units or facilities for all the following: – releases of highly hazardous chemicals? – toxic, corrosive, or flammable sprays, fumes, mists, or vapors? – thermal radiation from fires (including flares)? – overpressure from explosions? – contamination from spills or runoff? – transport of hazardous materials from other sites?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
7. Are there safe exit routes from each unit and process area? Does there appear to be enough landings, ladders, and stairs to properly access equipment and provide for evacuation in emergencies?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
8. Has equipment been adequately spaced and located to safely permit anticipated maintenance (e.g., pulling heat exchanger bundles, dumping catalyst, lifting with cranes) and hot work? *Does the spacing and location present a significant process hazard?*	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
9. Is there adequate access for emergency vehicles (e.g., fire trucks and rescue vehicles)? Are access roads free of the possibility of being blocked by trains, highway congestion, spotting of rail cars, etc.?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
10. Are access roads well engineered to avoid sharp curves? Are traffic signs provided? Are driving, parking, and process areas where vehicles, forklifts, and mobile equipment can fit clearly marked with signs, lines on pavement, guardrails, posts, and/or other barriers? Are the signs, lines, and barriers sufficient to protect process equipment and piping from vehicles and lifting equipment? Are vehicle barriers installed to prevent impact to critical equipment adjacent to high traffic areas?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):* Will change traffic route for large vehicles
11. Is vehicular traffic appropriately restricted from areas where pedestrians could be injured or equipment damaged? Are piping and equipment protected from vehicles, forklifts, and other lift equipment/operations? Are small-bore lines (<1") and fittings protected from external impact and reinforced when in a service where they experience vibration?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
12. Are cooling towers located such that fog that is generated by them will not be a hazard?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
13. Is the unit, or can the unit be, located to minimize the need for offsite or intra-site transportation of hazardous materials?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
14. Could specific siting hazards be posed to the site from credible external forces such as high winds, earth movement, and utility failure from outside sources, flooding, natural fires, or fog?	No	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
15. Are pipe bridges located such that they are not over equipment, including control rooms and administration buildings?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
16. Where applicable, are safeguards in place to protect high structures against low flying aircraft?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
17. Are appropriate security safeguards in place (e.g., fences, guard stations)?	No	*Identified Hazard (Finding):* Add fencing near pilot building *Risk (qualitative assessment):*
B. LOCATION OF CHEMICAL INVENTORIES		
1. Are large inventories of highly hazardous chemicals located away from the process area?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Is temporary storage provided for raw materials and for finished products at appropriate locations (e.g., chemical cylinders and totes, additive pallets)? Are the inventories of highly hazardous chemicals held to a minimum especially in process areas?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Where applicable, are reflux tanks, surge drums, and rundown tanks located in a way that avoids the concentration of large volumes of highly hazardous chemicals in any one area?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Where applicable, has special consideration been given to the storage and transportation of explosives?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Have the following been considered in the location of material handling areas: – fire hazards? – location relative to important buildings and off-site exposures? – safety devices (e.g., sprinklers)? – slope and draining of the area?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
C. LOCATION OF LOADING / UNLOADING AND STORAGE FACILITIES		
1. Was the area(s) designed with spill control, drainage direction, destination, and/or treatment capacity?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Are materials segregated by storage, dikes, sumps, drains, sewers, waste etc.? Is there adequate segregation of materials that are incompatible that if mixed could lead to a significant release of event?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
3. Are tank service changes governed by an MOC process?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Is the area labeled with unloading spots when different materials are handled?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Are grounding/bonding equipment in place to protect against static discharges and is the equipment periodically inspected?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
D. LOCATION OF ENGINEERING, LAB, ADMINISTRATION, OR OTHER BUILDINGS AND STRUCTURES		
1. Are all buildings and structures adequately protected by separation or building construction from HHC inventories and release points? Are administration buildings located away from inventories or release points of highly hazardous chemicals?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Has any building occupancy increased since the last PHA? Have these changes been evaluated including the technical basis, safety and health impacts, and emergency plans updated as needed?	Yes	*Identified Hazard (Finding):* Need to update emergency plans *Risk (qualitative assessment):*
3. Have buildings or trailers been added or moved? Have these changes been evaluated including the technical basis, safety and health impacts, and emergency plans updated as needed?	No	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Have there been process changes that might present a hazard to buildings, trailers, temporary structures, pipe-racks, or HHC inventories? Have these changes been evaluated including the technical basis, safety and health impacts, and emergency plans updated as needed?	No	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Has the hazards associated with the location of equipment on the roof of buildings (e.g. HVAC equipment) been evaluated?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
6. Can building ventilation system(s) prevent air ingress or air movement within the building? Are there hydrocarbon and/or toxic detectors that shutdown the fresh air intake? Does the building have a pressurization system? Are there procedures or process to purge supplied air at restart?	No	*Identified Hazard (Finding):* Contact Tracy Clem for clairification *Risk (qualitative assessment):*
7. Is there a back-up air system (breathing air or similar)? Is there sufficient bottled air for the building occupancy load? Are these regularly inspected to verify ready for use (adequate air, mask, hoses, etc.)?	No	*Identified Hazard (Finding):* Contact Tracy Clem for clairification *Risk (qualitative assessment):*
8. Are indoor safety control systems such as sprinklers and fire walls provided in buildings where personnel will frequently be located, such as control rooms and administrative buildings?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
9. Are workers in buildings (or their escape routes) protected from all of the following: – toxic, corrosive, or flammable sprays, fumes, mists, or vapors? – thermal radiation from fires (including flares)? – overpressure and projectiles from explosions? – contamination of utilities (e.g., water)? – contamination from spills or runoff? – transport of hazardous materials from other sites?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
E. LOCATION OF THE MOTOR CONTROL CENTER		
1. Is the motor control center (MCC) located so that it is easily accessible to operators in emergencies away from known hazards?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Are circuit breakers easy to identify?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Is the motor control center designed such that it could not be an ignition source? Are the doors always closed? Is the motor control center designed and meant to be a safe haven?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
F. LOCATION AND DESIGN OF CONTROL ROOMS		
1. Is the control room built to satisfy current corporate overpressure and safe-haven standards? Does the design basis and construction for the control room satisfy acceptable criteria (e.g., the Factory Mutual recommendations)? Is a positive pressure maintained in control rooms located in hazardous areas?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
2. Are workers protected in the control room (or their escape routes) from all of the following: – toxic, corrosive, or flammable sprays, fumes, mists, or vapors? – thermal radiation from fires (including flares)? – overpressure and projectiles from explosions? – contamination from spills or runoff? – transport of hazardous materials from other sites?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Is at least one exit located in a direction away from the process area? Do exit doors open outward? Are emergency exists provided for multi-storied control buildings?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Are vessels containing highly hazardous chemicals located sufficiently far from control rooms? Is the control room located a sufficient distance from sources of excessive vibration? Are open pits, trenches, or other pockets where inert, toxic, or flammable vapors could collect located away from control buildings or equipment handling flammable fluids?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Were the following characteristics considered when the control room location was determined: – types of construction of the room? – types/quantities of materials? – direction and velocity of prevailing winds? – types of reactions and processes? – operating pressures and temperatures? – ignition sources? – fire protection facilities? – drainage facilities?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
6. If windows are installed, are they of rigid construction with sturdy panes (e.g., woven-wire reinforced glass)?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
7. Are critical pieces of equipment in the control room well protected? Is adequate barricading provided for the control room?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
8. Where piping, wiring, and conduit enter the building, is the building sealed at the point of entry? Have other potential leakage points into the building been adequately sealed?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
9. Could any structures fall on the control room in the event of an accident?	No	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
10. Is the roof of the control room free from heavy equipment and machinery (e.g. HVAC)?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
G. LOCATION OF MACHINE SHOPS, WELDING SHOPS, ELECTRICAL SUBSTATIONS, ROADS, RAIL SPURS, AND OTHER POTENTIAL IGNITION SOURCES		
1. Are likely ignition sources (e.g., maintenance shops, roads, rail spurs) located away from – release points for volatile substances (both liquid and vapor)? – process sewers, pits, etc. – vessels containing highly hazardous chemicals or components containing material above its flash point	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Are flares and fired heater systems located to minimize hazards to personnel and equipment, with consideration given to normal wind direction and wind velocity, as well as heat potential?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
H. LOCATION AND ADEQUACY OF DRAINS, SPILL BASINS, DIKES, AND SEWERS		
1. Are spill containments sloped away from process inventories and potential sources of fire? Do drains empty to areas where material cannot pool?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Have precautions been taken to avoid open ditches, pits, sumps, or pockets where inert, toxic, or flammable vapors could collect?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Are process sewers that transport hydrocarbons closed systems?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Are concrete bulkheads, barricades, or berms installed to protect personnel and adjacent equipment from explosion and/or fire hazards?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
5. Can dikes hold the capacity of the largest tank plus 10%?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
6. Is there a means of access in and out of dikes, pits, etc.?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
I. LOCATION OF EMERGENCY STATIONS (FIRST AID, SHOWERS, EYE WASH, ETC.)		
1. Are safety showers/eye wash stations within a safe travel distance from known hazards (10-second walk or approximately 55 feet)?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Are safety showers heated/freeze-protected/wind-protected as needed?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Are temporary safety showers and/or eye wash stations (or other means) made available for temporary operations, maintenance, or activities (e.g. line break and equipment opening) that may present a hazard?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Is there a control room alarm for water flow from a safety shower or eyewash station?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Are first aid stations prudently located and adequately equipped?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
J. ELECTRICAL CLASSIFICATION		
1. Is there an electrical classification document? Does the electrical classification appear correct and complete? Does the electrical classification adequately reflect the effects of different modes of operation (e.g., normal operation, maintenance, startup, infrequent operating modes such as reactor regeneration or operation with a portion of the system bypassed)? Are Division 1 areas necessary (if there are any)?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
2. Have significant changes made since the system was originally constructed been included in the electrical classification document, including: – addition of new materials? – new sources of flammable gases or vapors? – new low points (e.g., sumps or trenches) at grade? – areas that have been enclosed since the system was constructed?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Are all equipment designed for the proper electrical hazardous area classification and are equipment seals in place including conduit boxes and conduit seal plugs poured with seal compound? Are there adequate controls to ensure that electrically classified equipment is replaced with equipment of equal or higher classification?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
4. Are boundaries between electrically classified areas physical boundaries? If not: – are the boundaries marked? – are workers adequately informed of the boundaries of electrically classified areas and their significance?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Are the design and maintenance of ventilation systems adequate, including: – safeguards to alert operators when a ventilation system fails? – ventilation systems being properly maintained and alarms and interlocks on these systems periodically function-checked? – adequate maintenance being done to function-check natural ventilation systems? – technical basis for design changes to the ventilation system? – ventilation systems verified to be adequate for new gas or vapor loads?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
K. EMERGENCY RESPONSE		
1. Are there hydrocarbon and/or toxic detectors that are maintained within a calibration and inspection program? Are they adequate to detect and help mitigate releases in the areas being studied?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
2. Are isolation valves easily accessible and located away from known hazards (pipe-racks and HHC inventories) if possible? If located near known hazards, are they adequately protected to ensure they function as needed and/or are there alternate means to isolate or mitigate?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
3. Do large HHC inventories (large vessels and columns) have rapid isolation capability?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

Question	Response (Y / N / N/A)	Comments
4. Can personnel easily detect leaks/ruptures in the area? Are process-containing piping or equipment visible so that leaks can be detected?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
5. Are fire equipment (hydrant, monitor, and deluge valves) and other emergency services located at ground level, without obstructions which could interfere with hand-on operation?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
6. Are fire equipment (hydrant, monitor, and deluge valves) and other emergency services located away from known hazards, pipe racks, and HHC inventories that might present a hazard to employees operating the fire equipment?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
7. Is fireproofing insulation where required on process piping, equipment, critical controls, cable trays, critical utilities, and support structures installed; regularly inspected per MI program and procedures; and in good condition? Is fireproofed equipment adequately protected from or routed away from pumps and compressors and other known hazards where seal fires could damage them?	NA	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*
8. Have all sources of ignition been eliminated or controlled? Are there any ignition sources such as flares or hot oil heaters (continuous, occasional/intermittent, and uncontrolled) within 250 feet of likely release points (e.g., vents, drains, etc.)?	Yes	*Identified Hazard (Finding):* *List Existing Safeguards:* *Risk (qualitative assessment):*

This information was reviewed and discussed by the PHA team and the notes compiled by:

Name: Dave Schmitz Date: 10/4/2012

ORIGINAL

FLINT HILLS RESOURCES CHEMICAL INTERMEDIATES, LLC.

PILOT PLANT CONTROL ROOM

501 BRUNNER STREET PERU, ILLINOIS 61354

BUILDING INFORMATION:

USE GROUP CLASSIFICATION: –

CONSTRUCTION TYPE:

ACTUAL FLOOR AREA: FIRST FLOOR ---S.F.
TOTAL: ---S.F.

ACTUAL BUILDING HEIGHT:

OPEN PERIMETER DISTANCES:	OVERALL	OPEN
NORTH	x'–x"	x'–x"
EAST	x'–x"	x'–x"
WEST	x'–x"	x'–x"
SOUTH =	x'–x"	x'–x"
TOTAL =	x'–x"	x'–x"

% OPEN PERIMETER= x100 = %

% TABULAR AREA INCREASE= = %

AREA MODIFICATIONS:
% OF ALLOWABLE TABULAR AREA = %
% REDUCTION FOR HEIGHT = %
% INCREASE FOR OPEN PERIMETER = %
% INCREASE FOR AUTOMATIC SPRINKLERS = %

TOTAL = %/100 =

ALLOWABLE FLOOR AREA PER FLOOR:
– S.F.

ALLOWABLE BUILDING HEIGHT:

INCREASED ALLOWABLE FLOOR AREA:
NOT REQUIRED (ACTUAL LESS THAN ALLOWABLE)

OCCUPANT LOAD: MAXIMUM ACTUAL
(NORMALLY UNOCCUPIED) =

REQUIRED EXITS PER FLOOR: REQUIRED ACTUAL

MINIMUM EXIT DOOR WIDTH: INCHES

LENGTH OF EXIT ACCESS TRAVEL: REQUIRED ACTUAL

FIRE SEPARATION ASSEMBLIES RATINGS:	WALLS	DOORS
EXTERIOR WALLS LOAD BEARING	– HOUR	– HOUR
(EXTERIOR WALLS NON-LOAD BEARING	– HOUR	– HOUR
0' TO 5'	– HOUR	– HOUR
> 5' TO 10'	– HOUR	– HOUR
> 10' TO 30'	– HOUR	– HOUR
> 30'	– HOUR	– HOUR

DESIGN LOADS:

ROOF LIVE LOAD – PSF
SNOW LOAD – PSF
ROOFING/FRAMING/MECH DEAD LOAD – PSF

TOTAL LOAD – PSF

ABBREVIATIONS:

H.P. – HIGH POINT
L.P. – LOW POINT
F.F. – FINISHED FLOOR
O.H. – OVER HANG
F.D. – FLOOR DRAIN
C.O. – CLEAN OUT
D.S. – DOWN SPOUT
G.B. – GLASS BLOCK
M.O. – MASONRY OPENING
R.O. – ROUGH OPENING
V.T.R. – VENT TO ROOF
F.A.I. – FAN AIR INTAKE
T.O.C. – TOP OF CONCRETE
T.O.W. – TOP OF WALL
B.O.W. – BOTTOM OF WALL
F.R.P. – FIBERGLASS REINFORCEMENT PLASTIC

OWNER:

FLINT HILLS RESOURCES CHEMICAL INTERMEDIATES, LLC.
501 BRUNNER STREET, PERU, IL 61354
PH: (815) 224-1525 FAX: --

PROJECT ARCHITECT/ENGINEER:

J.L. MEECE ENGINEERING, INC.
760 S. BROADWAY, P.O. BOX 159, COAL CITY, IL 60416
815-631-2727 FAX 815-634-2739

GENERAL CONTRACTOR:

–

ELECTRICAL CONTRACTOR:

–

PLUMBING CONTRACTOR:

–

MECHANICAL CONTRACTOR:

–

STATEMENT OF COMPLIANCE:

I HAVE PREPARED, OR CAUSED TO BE PREPARED UNDER MY DIRECT SUPERVISION, THE ATTACHED PLANS AND SPECIFICATIONS AND STATE THAT, TO THE BEST OF MY KNOWLEDGE AND BELIEF AND TO THE EXTENT OF MY CONTRACTUAL OBLIGATION, THEY ARE IN COMPLIANCE WITH THE ENVIRONMENTAL BARRIERS ACT (410 IL CS 25) AND THE ILLINOIS ACCESSIBILITY CODE (71 ILL. ADM. CODE 400).

SIGNED: ______________________
ARCHITECT

ILLINOIS LICENSE NO.: ______________________

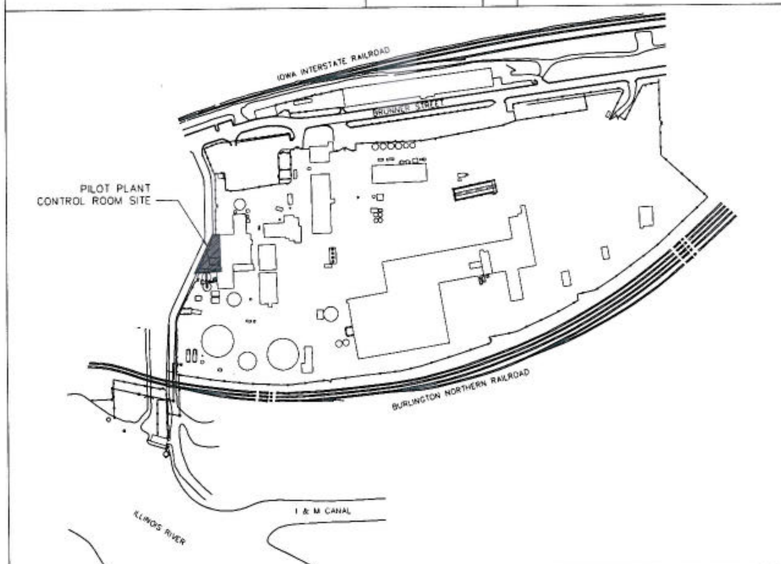
DATE: ______________________

GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO PROJECT SPECIFICATIONS & DRAWINGS, INTERNATIONAL BUILDING CODE (IBC 2003 AS ADOPTED BY THE CITY OF PERU, IL), AND ALL OTHER APPLICABLE STATE AND LOCAL CODES.
2. ALL PLUMBING WORK SHALL CONFORM TO THE ILLINOIS STATE PLUMBING CODE, 2004.
3. ALL ELECTRICAL WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE (NEC) 2005.
4. ALL FIRE PROTECTION WORK SHALL CONFORM TO NFPA 13.
5. ALL HVAC WORK SHALL CONFORM TO THE INTERNATIONAL MECHANICAL CODE (2003) AND SMACNA LOW PRESSURE DUCT CONSTRUCTION STANDARDS.
6. ALL WORK SHALL CONFORM TO ALL CURRENT LOCAL CODES & ORDINANCES.
7. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, CLEARANCES, AND ELEVATIONS PRIOR TO START OF CONSTRUCTION.

SCHEDULE OF DRAWINGS

Number	Rev.	Title
2012-162-CD-09	0	CIVIL – TITLE SHEET
2012-162-CD-10	0	CIVIL – SITE PLAN
2012-162-CD-11	0	CIVIL – LOCATION PLAN
2012-162-CD-12	0	CIVIL – WEST ELEVATION & H.R. DETAILS
2012-162-CD-13	0	CIVIL – NORTH ELEVATION
2012-162-CD-14	0	CIVIL – SECTION
2012-162-CD-15	0	CIVIL – FOOTING & FOUNDATION PLAN
2012-162-CD-15A	0	CIVIL – BUILDING ANCHOR PLAN & DETAILS
2012-162-CD-16	0	CIVIL – CONCRETE/SITE WORK DETAILS
2012-162-CD-17	0	CIVIL – CONCRETE DETAILS
2012-162-ED-02	0	ELECTRICAL – GROUNDING PLAN & DETAILS
2012-162-PD-02	0	PIPING – UNDERGROUND PIPING PLAN



LEGEND

SYMBOL	DESCRIPTION
	EARTH
	GRANULAR FILL
	CONCRETE
	CONCRETE BLOCK
	BRICK
	STEEL
	STONE
	ROUGH LUMBER
	FINISHED LUMBER
	PLYWOOD
	CERAMIC TILE
	BATT INSULATION
	RIGID INSULATION

1 / A2 DETAIL MARK — DETAIL OR SECTION NO. — DRAWING NO. DETAIL OR SECTION APPEARS ON

A / A2 SECTION MARK

A / A2 ELEVATION MARK

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760 S. Broadway, Coal City, IL 60416
(815) 634-2727 Fax (815) 634-2739

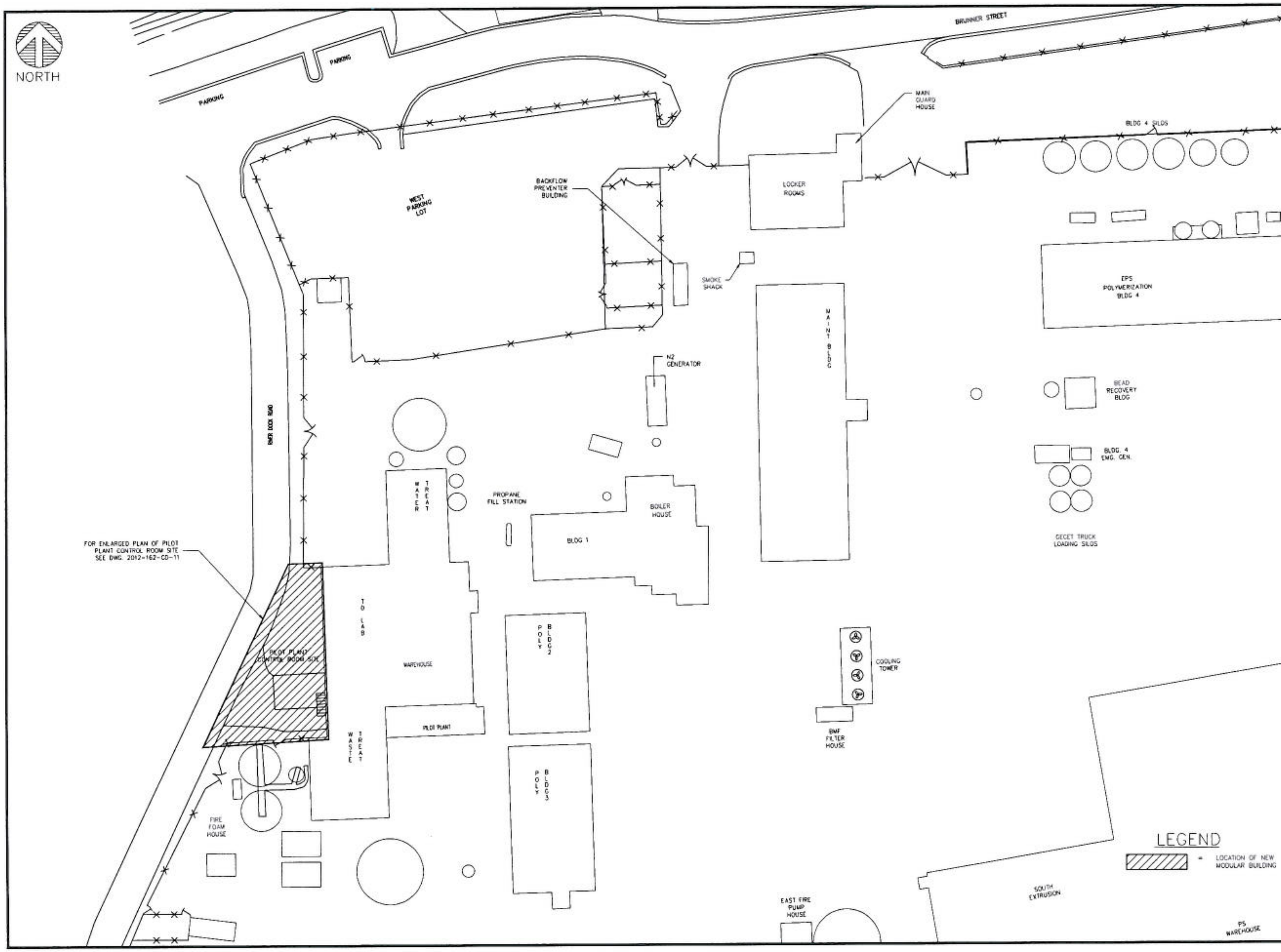
MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn ORB
Checked RW
Approved MT
Scale AS NOTED
Plot Scale 1:1
Date 9/27/12

FLINT HILLS RESOURCES CHEMICAL INTERMEDIATES, LLC
FACILITIES SITING PROJECT
TITLE SHEET
PILOT PLANT CONTROL ROOM

CAD File Name 2012-162-CD-09.dwg
Dwg. No. 2012-162-CD-09
Rev. 0

FHRPRU001647



NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL ELEVATIONS, CLEARANCES AND DIMENSIONS, INCLUDING WORK BY OTHERS, PRIOR TO START OF WORK OR FABRICATION.
2. CONTRACTOR SHALL EMPLOY THE SERVICES OF A PRIVATE UNDERGROUND UTILITY LOCATOR TO SURVEY ALL UNDERGROUND SERVICES IN, AROUND, AND BENEATH THE AREA OF WORK PRIOR TO BREAKING GROUND. ALL EXISTING PLANT AND MUNICIPAL UTILITIES SHALL REMAIN UNDISTURBED.
3. MEANS, METHODS AND FINAL CONSTRUCTION SHALL CONFORM TO THE LATEST O.S.H.A. REGULATIONS. THE FOLLOWING SPECIFICATIONS AND STANDARDS ALSO APPLY:

FABRICATION, PLACEMENT, AND ALL CONSTRUCTION:	ACI-318-11
JOINT MATERIALS:	ASTM D-544
NON-SHRINK GROUT:	ASTM C-1107
WELDED WIRE FABRIC:	ASTM A-185
CEMENTS:	ASTM C-150, TYPE I OR II, EXCEPT TYPE V FOR SULFATE RESISTANCE AS NOTED.
AGGREGATES:	ASTM C-33 FOR NORMAL WEIGHT, C-330 FOR LIGHT WEIGHT
WATERPROOF PAPER OR PLASTIC FILM:	ASTM C-171
LIQUID MEMBRANE FORMING CURING COMPOUNDS:	ASTM C-309
MIXTURES AND PRODUCTION OF CONCRETE:	ACI-301
CONSOLIDATION OF CONCRETE:	ACI-309
REINFORCING STEEL:	ASTM A-615 GR.40 FOR #3 BARS, GR.60 FOR #4 & LARGER BARS.
ANCHOR BOLTS HOT DIP GALVANIZED:	ASTM F1554, GR. 36
WELDED REINFORCING STEEL:	ASTM-706

4. VAPOR RETARDER FOR UNDER SLAB USE SHALL BE 10 MIL MINIMUM THICKNESS AND CONFORM TO ASTM-E1745.
5. EPOXY SHALL BE HILTI HIT OR AN EQUAL APPROVED BY THE ENGINEER.
6. CONCRETE PATCHING SHALL BE SIKATOP 122 MORTAR MANUFACTURED BY SIKA CORP. OR AN EQUAL APPROVED BY THE ENGINEER.
7. CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 4000 P.S.I. MINIMUM, WITH A MAXIMUM WATER/CEMENT RATIO OF 0.45, AND MINIMUM AIR ENTRAINMENT OF 6%. COLD WEATHER CONCRETING SHALL BE PERFORMED PER ACI 306R-10.
8. NON-SHRINK GROUT SHALL HAVE A COMPRESSIVE STRENGTH OF AT LEAST 5000 P.S.I. AT 3 DAYS.
9. DIMENSIONS SHOWN ON THE DRAWINGS FOR REINFORCING BARS ARE TO THE FACE OF BARS AND DENOTE CLEAR COVERAGE. UNLESS SPECIFICALLY NOTED THE FOLLOWING CLEARANCES APPLY:

CONCRETE DEPOSITED DIRECTLY AGAINST EARTH:	3"
CONCRETE EXPOSED TO EARTH OR WEATHER BUT CAST IN FORMS:	2"
CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND:	1½"
WALLS, INTERIOR FACE:	¾"
SLABS ON GRADE:	2" FROM TOP

10. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾".
11. ALL SLAB SURFACES SHALL HAVE A LIGHT-BROOM FINISH UNLESS NOTED OTHERWISE.
12. PROVIDE (2) #5 X 48" DIAGONAL BARS AT ALL INTERIOR (RE-ENTRANT) CORNERS UNLESS NOTED OTHERWISE.
13. UNLESS SPECIFICALLY NOTED, SPLICE LENGTHS SHALL BE 40 BAR DIAMETERS AND ADJACENT BAR SPLICES SHALL BE AT LEAST 36" APART. ALTERNATIVELY, SPLICE LENGTHS MAY BE INCREASED TO 1.3X SPECIFIED DISTANCE WITHOUT STAGGERING SPLICES. LAP SPLICE W.W.F. 2 MESHES MINIMUM. #5 AND SMALLER BARS MAY BE FIELD RE-BENT (1) TIME ONLY AS REQUIRED.
14. UNLESS SPECIFICALLY NOTED ON PLANS, SLAB CONTRACTION JOINTS SHALL BE SPACED AT 24 X SLAB THICKNESS, AND SAW CUTTING SHALL BE PERFORMED DIRECTLY AFTER FINISHING.
15. ALL BELOW GRADE CONCRETE WORK SHALL BE PERFORMED ACCORDING TO THE GEOTECHNICAL REPORT TO BE PROVIDED BY THE OWNER.
16. UNLESS OTHERWISE NOTED IN THE GEOTECHNICAL REPORT, ALL SUBGRADE MATERIALS SHALL BE PLACED IN LIFTS NOT TO EXCEED 6" AND COMPACTED TO A MINIMUM OF 95% STANDARD PROCTOR DENSITY.

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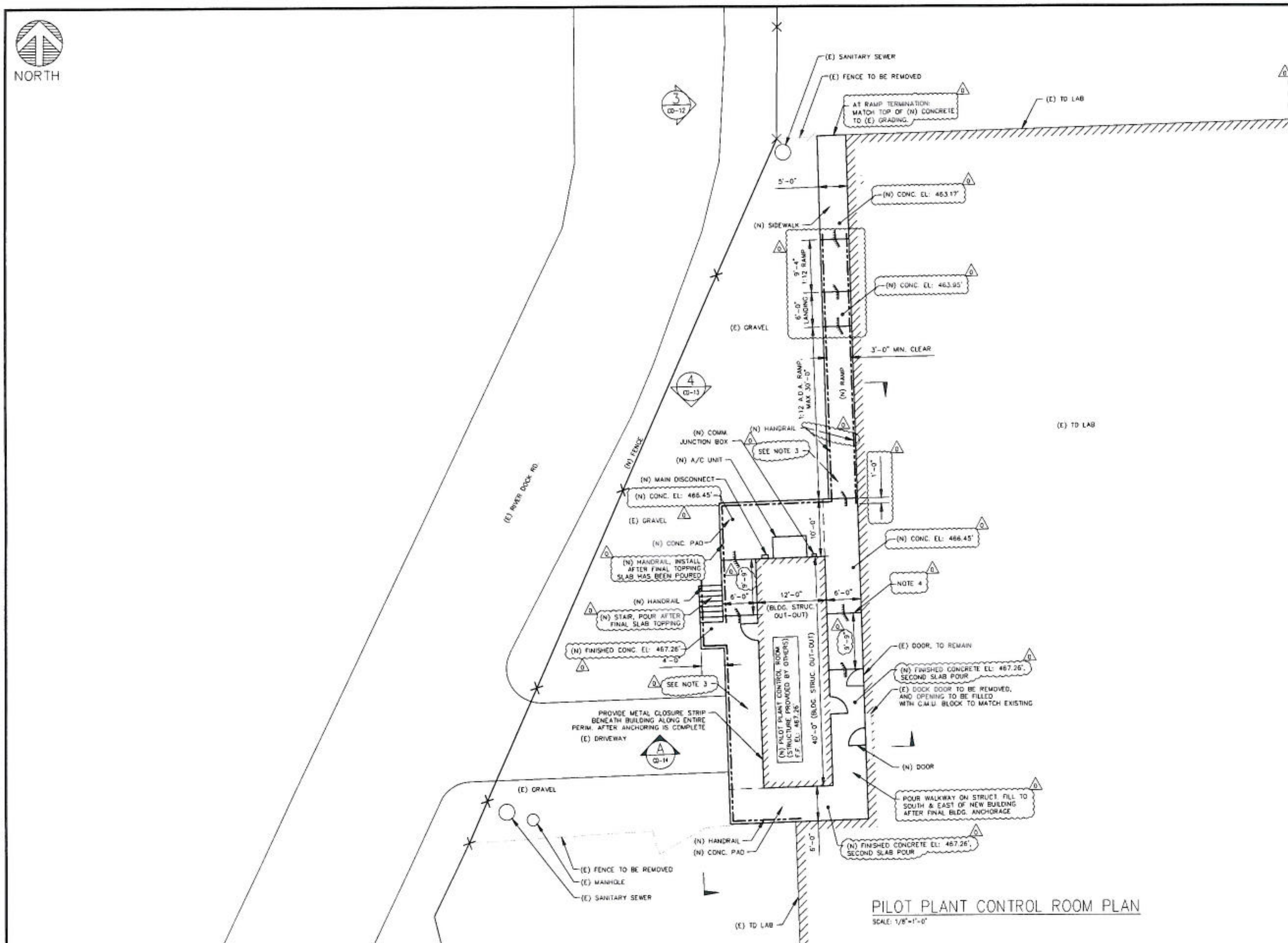
MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn DRB	FLINT HILLS RESOURCES
Checked RW	CIVIL
Approved MT	SITE PLAN
Scale 1/32" = 1'	PILOT PLANT CONTROL ROOM
Plot Scale 1:1	CAD File Name 2012-162-CD-10.dwg
Date 7/25/12	Dwg. No. 2012-162-CD-10
Rev.	0

FHRPRU001648



PILOT PLANT CONTROL ROOM PLAN

SCALE: 1/8"=1'-0"

NOTES:

1. SEE SHEET 2012-162-CD-10 FOR GENERAL NOTES.
2. REFER TO 2012-162-CD-15 CONCRETE PLAN FOR ADD'L FOUNDATION AND GRADING/ELEVATION INFO.
3. PITCH SLABS AND RAMPS DOWN ¼" AWAY FROM BUILDING.
4. IF FINAL ALIGNMENT IS OVERLAID, GRIND/CHIP 8" WIDE POCKET INTO FIRST POUR TO PREVENT FEATHERED EDGE.

LEGEND

(N) = NEW

(E) = EXISTING

—S— = SANITARY SEWER

—W— = POTABLE WATER

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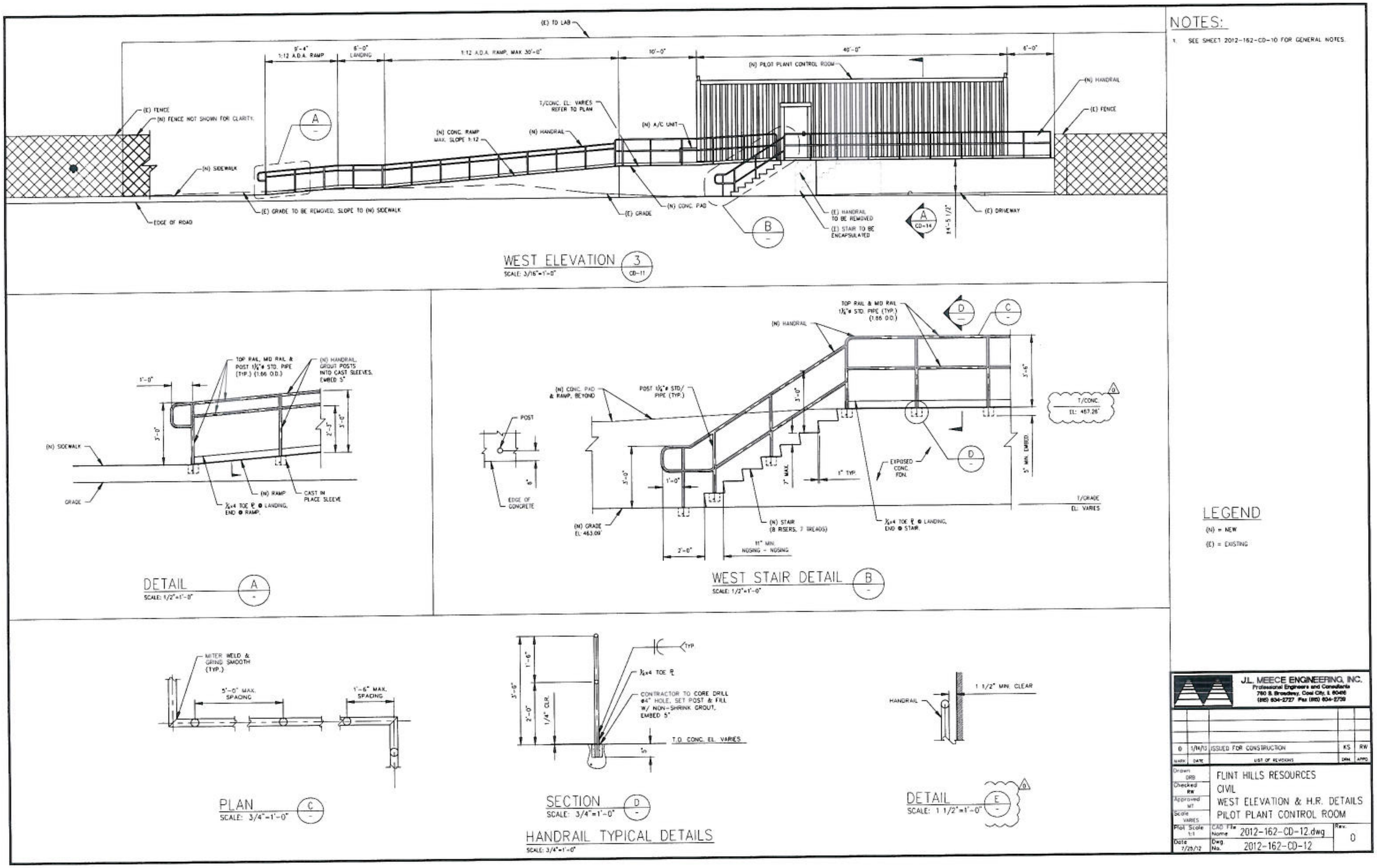
MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn DRB	FLINT HILLS RESOURCES
Checked RW	CIVIL
Approved MT	LOCATION PLAN
Scale 1/8" = 1'	PILOT PLANT CONTROL ROOM
Plot Scale 1:1	CAD File Name 2012-162-CD-11.dwg
Date 7/25/12	Dwg No. 2012-162-CD-11
Rev.	0

FHRPRU001649



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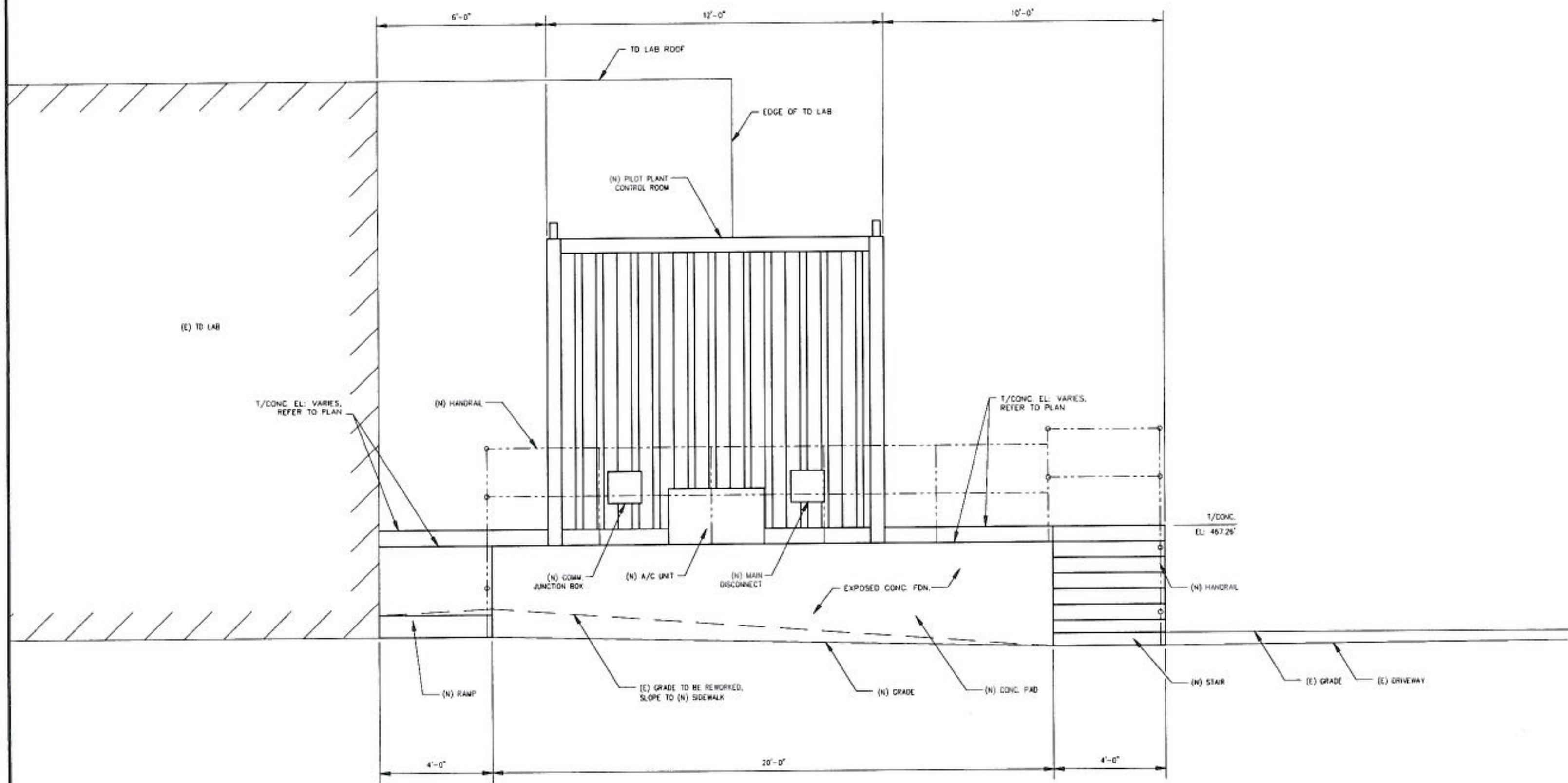
NOTES:

1. SEE SHEET 2012-162-CD-10 FOR GENERAL NOTES.



NORTH ELEVATION (4 / CD-11)

SCALE: 1/2"=1'-0"

LEGEND

(N) = NEW

(E) = EXISTING

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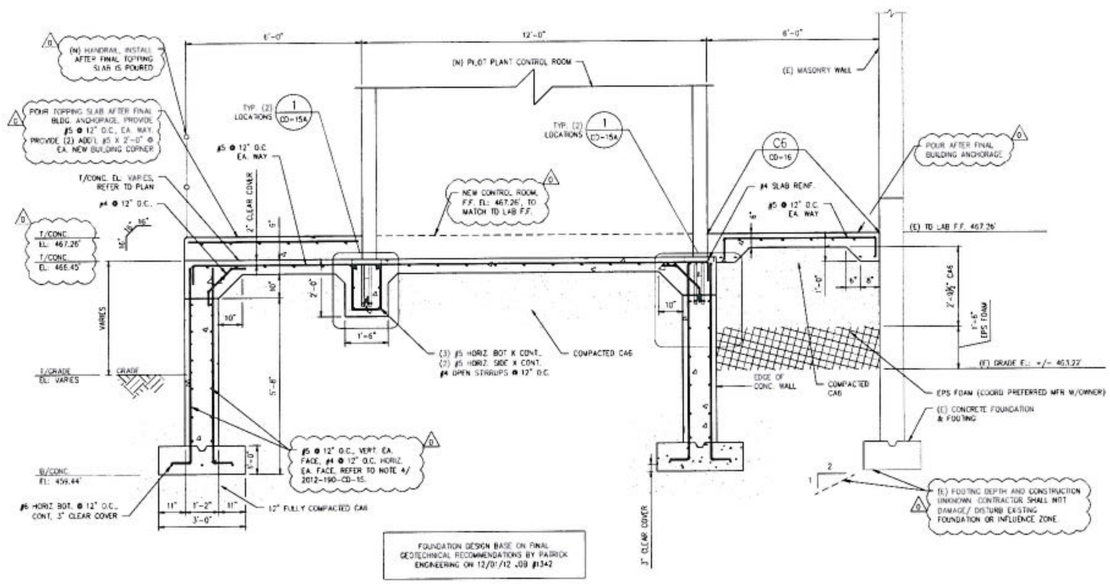
MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn: DRB	FLINT HILLS RESOURCES
Checked: RW	CIVIL
Approved: MT	NORTH ELEVATION
Scale: 1/2" = 1'	PILOT PLANT CONTROL ROOM
Plot Scale: 1:1	CAD File Name: 2012-162-CD-13.dwg — Rev. 0
Date: 7/25/12	Dwg No.: 2012-162-CD-13



SECTION A
SCALE: 1/2"=1'-0"
CD-11
CD-15

NOTES:

1. SEE SHEET 2012-162-CD-10 FOR GENERAL NOTES.
2. REMOVE EXISTING STEEL BOLLARDS PRIOR TO CONSTRUCTION (ADJACENT TO (E) BLDG. DOCK).

LEGEND

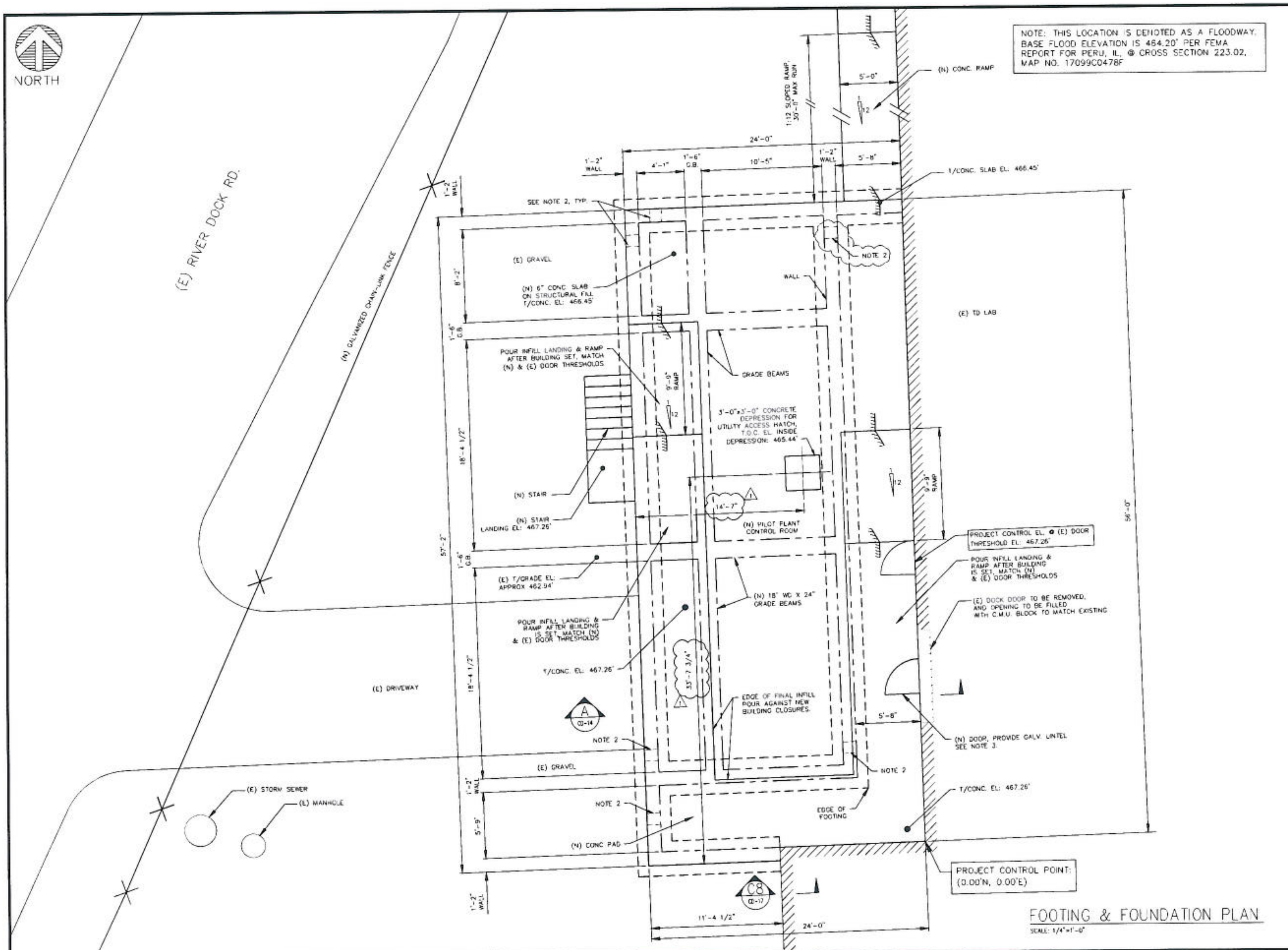
(N) = NEW

(E) = EXISTING

J.L. MEECE ENGINEERING, INC.
Professional Engineers and Consultants
760 S. Broadway, Coal City, IL 60416
(815) 634-2727 Fax (815) 634-2739

MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn CRB	FLINT HILLS RESOURCES
Checked RW	CIVIL
Approved MT	SECTION
Scale VARIES	PILOT PLANT CONTROL ROOM
Plot Scale 1:1	CAD File Name 2012-162-CD-14.dwg — Rev. 0
Date 7/26/12	Dwg. No. 2012-162-CD-14



FOOTING & FOUNDATION PLAN

SCALE: 1/4"=1'-0"

NOTES:

1. SEE SHEET 2012-162-CD-10 FOR GENERAL NOTES.
2. PROVIDE 8" CMU BLOCK HYDROSTATIC RELIEF VENT AT 12" OR LESS ABOVE ADJACENT GRADE. TURN BLOCK ON SIDE. PROVIDE DEBRIS AND INSECT SCREEN ALONG INTERIOR AND EXTERIOR OF TURNED BLOCK. INCLUDE ADDITIONAL #4 CRACK CONTROL BARS, PLACE DIAGONAL AT CORNERS OF VENTS.
3. PROVIDE L4x3½x¼ LLV GALV LINTEL FOR EA. 4" OF WALL THICKNESS. FINISH W/ ½" GALV TIE PLATE WELDED TO EXPOSED UNDERSIDE OF LOOSE LINTELS. TOUCH UP WITH COLD GALV COMPOUND AFTER WELDING. (PLATE WIDTH: TOTAL WIDTH OF STEEL LESS 2"). PROVIDE MIN 8" BEARING @ EA. LINTEL END. CONTRACTOR IS RESPONSIBLE FOR SHORING AND BRACING DURING CONSTRUCTION.
4. AT ALL NEW WALL CORNERS PROVIDE (4) #4 CORNER BARS W/ 90° BEND, EQ/ SPACED ALONG WALL HEIGHT. EA. HORIZ. LEG SHALL BE 2'-0" LONG AND TIED TO OUTER LAYER OF TYP. HORIZ. WALL REINF.

LEGEND

(N) = NEW

(E) = EXISTING

G.B. = GRADE BEAM

NOTE: NEW BUILDING OMITTED FROM THIS PLAN FOR CLARITY.

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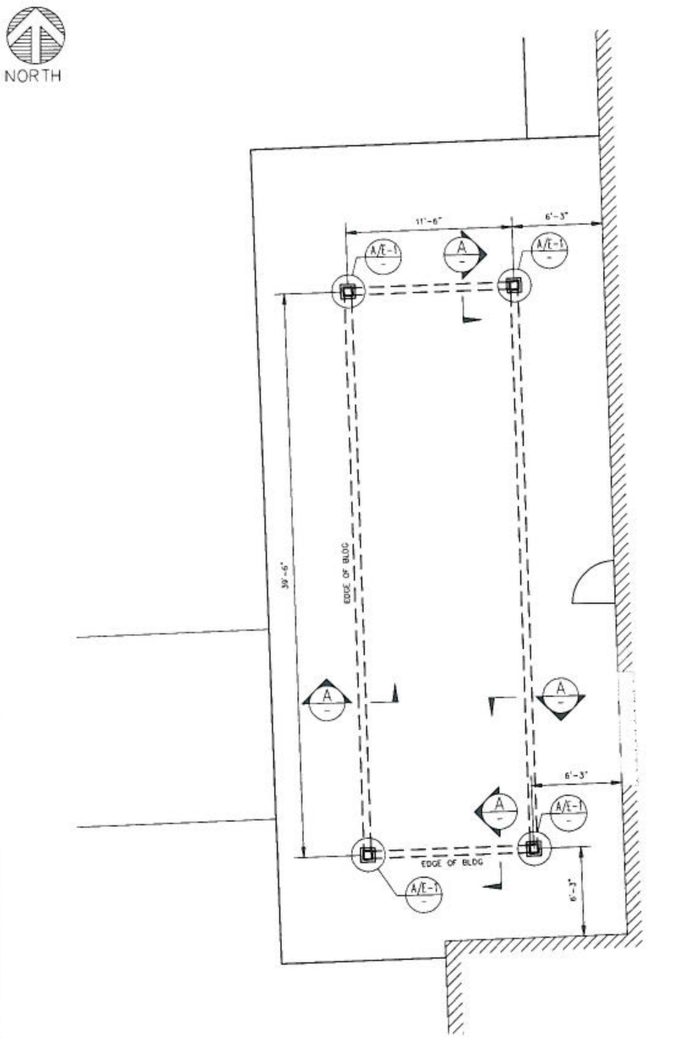
MARK	DATE	LIST OF REVISIONS	DRN	APPD
1	1/7/13	RE-ISSUED FOR CONSTRUCTION	DRB	RW
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn DRB	FLINT HILLS RESOURCES
Checked RW	CIVIL
Approved MT	FOOTING & FOUNDATION PLAN
Scale 1/4" = 1'	PILOT PLANT CONTROL ROOM
Plot Scale 1:1	CAD File Name 2012-162-CD-15.dwg — Rev. 1
Date 7/25/12	Dwg. No. 2012-162-CD-15

NORTH

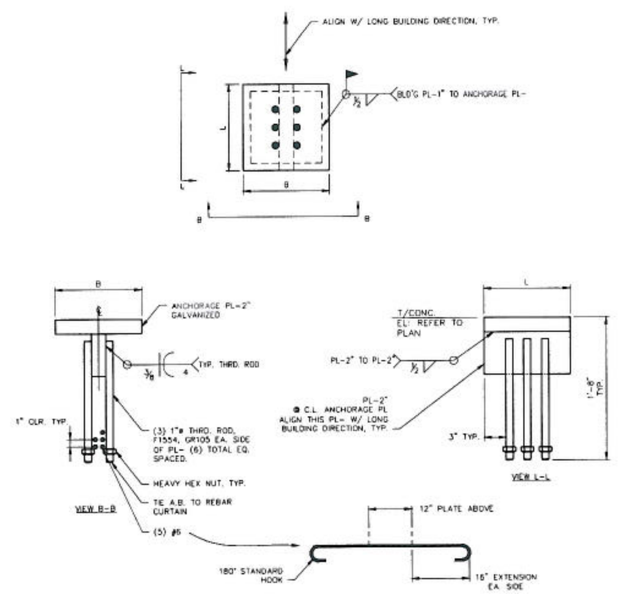


ANCHOR PLATE LOCATION PLAN

SCALE: 1/4"=1'-0"

NOTE: THIS LOCATION IS DENOTED AS A FLOODWAY. BASE FLOOD ELEVATION IS 464.20' PER FEMA REPORT FOR PERU, IL. @ CROSS SECTION 223.02, MAP NO. 17099C0478F

CONCRETE EMBED SCHEDULE			
EMBED ID	L (in.)	B (in.)	QTY
E-1	12	12	4



ANCHOR PLATE DETAIL

SCALE: 1 1/2"=1'-0"

NOTES:

1. SEE SHEET 2012-162-CD-10 FOR GENERAL NOTES.

LEGEND

(N) = NEW

(E) = EXISTING

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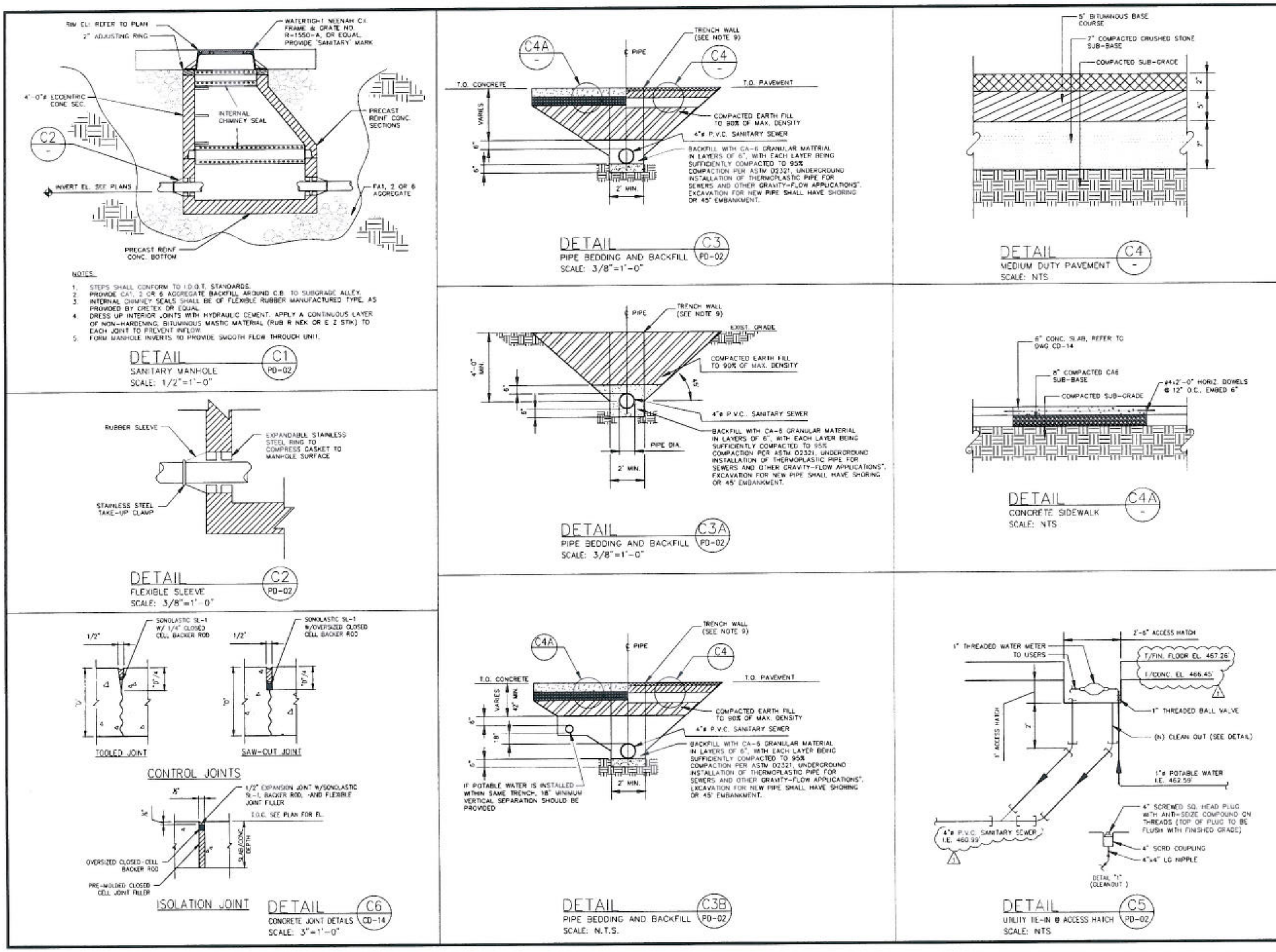
(815) 634-2727 Fax (815) 634-2709

MARK	DATE	LIST OF REVISIONS	DRN.	APPS.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn DRB	FLINT HILLS RESOURCES CIVIL BUILDING ANCHOR PLAN & DETAIL PILOT PLANT CONTROL ROOM
Checked RW	
Approved MT	
Scale 1/4" = 1'	
Plot Scale 1:1	CAD File Name 2012-162-CD-15A.dwg — Rev. 0
Date 7/25/12	Dwg No. 2012-162-CD-15A



NOTES:

1. FOR GENERAL NOTES AND LEGEND SEE DRAWING.
2. ALL WORK SHALL CONFORM TO ALL LOCAL CODE AND ORDINANCES.
3. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, CLEARANCES, ELEVATIONS; AND UNDERGROUND UTILITIES PRIOR TO START OF CONSTRUCTION.
4. PIPING MATERIALS SHALL BE PER SPECIFICATIONS AS LISTED BELOW PIPE FITTINGS BRANCH CONNECTIONS.
5. GRANULAR FILL SHALL BE A CA-6 COMPACTED TO 95% PROCTOR IN 6" LAYERS.
6. CONTRACTOR SHALL BE RESPONSIBLE TO LOCATE ALL UNDERGROUND UTILITIES.
7. CONTRACTOR SHALL DIG AROUND EXISTING UNDERGROUND SEWERS AND ELECTRICAL CONDUITS IN A CAUTIOUS MATTER SO THEY WILL NOT BE DISTURBED.
8. ALL SPOILS SHALL BE REMOVED IN AN APPROVED MANNER.
9. ANGLE OF REPOSE AS CALCULATED BY OSHA FOR SLOPING EXCAVATIONS IN VARIOUS TYPES OF SOIL (AVG. SOIL = 1:1 SLOPE) PORTABLE TRENCH BOXES OR SLIDING TRENCH SHIELDS MAY BE USED IN LIEU OF SLOPING.

LEGEND

(N) = NEW

(E) = EXISTING

—S— = SANITARY SEWER

—W— = PORTABLE WATER

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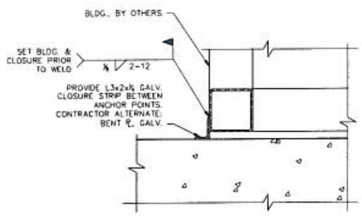
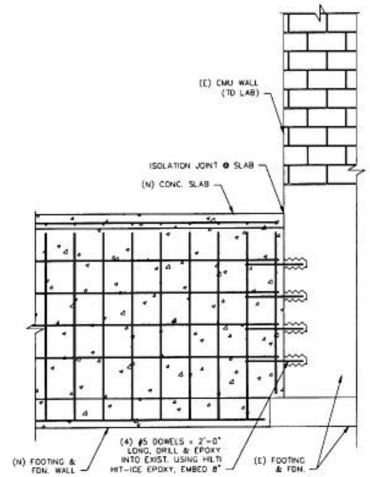
MARK	DATE	LIST OF REVISIONS	DRN	APPD
1	1/21/13	RE-ISSUED FOR CONSTRUCTION	DRB	RW
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn CJR	FLINT HILLS RESOURCES
Checked RW	CIVIL
Approved MT	CONCRETE/SITE WORK DETAILS
Scale VARIES	PILOT PLANT CONTROL ROOM
Plot Scale 1:1	CAD File Name 2012-162-CD-16.dwg — Rev. 1
Date 9/20/12	Dwg No. 2012-162-CD-16



SECTION C7 CD-15A
CLOSURE STRIP
SCALE: 1 1/2"=1'-0"



DETAIL C8 CD-15
FDN. WALL LOOKING NORTH
SCALE: 1/2"=1'-0"

NOTES:

1. SEE SHEET 2012-162-CD-01 FOR GENERAL NOTES.

LEGEND

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(E) = EXISTING

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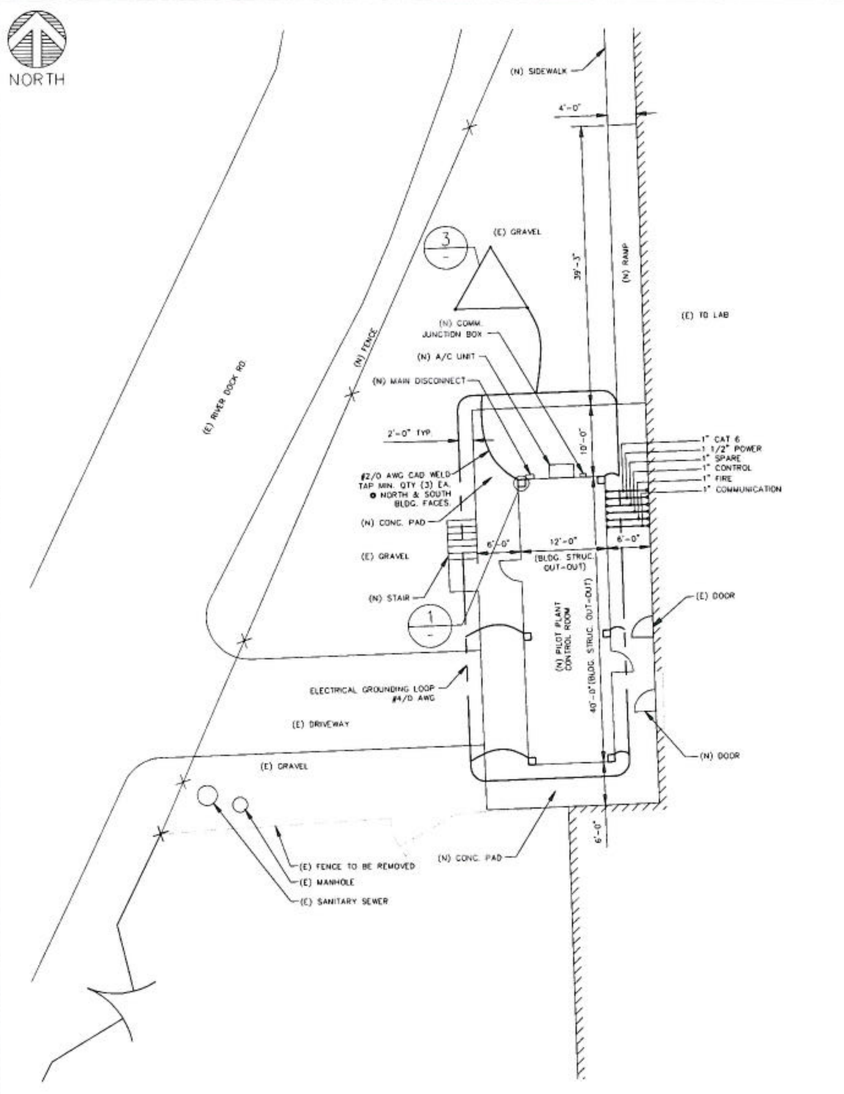
(815) 634-2727 Fax (815) 634-2739

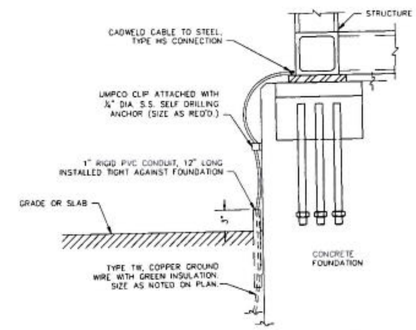
MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn DRB	FLINT HILLS RESOURCES
Checked RW	CIVIL
Approved MT	CONC. DETAILS
Scale AS SHOWN	PILOT PLANT CONTOL ROOM
Plot Scale 1:1	CAD File Name 2012-162-CD-17.dwg — Rev. 0
Date 7/25/12	Dwg. No. 2012-162-CD-17



PILOT PLANT CONTROL ROOM GROUNDING PLAN

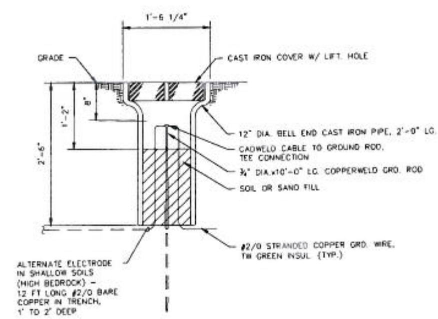
SCALE: 1/8"=1'-0"



DETAIL 1

GROUNDING CONNECTION

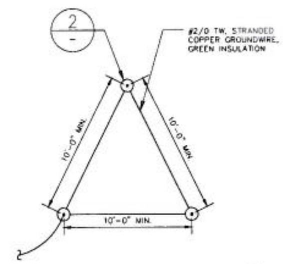
SCALE: 1 1/2"=1'-0"



DETAIL 2

GROUND WELL

SCALE: 1"=1'-0"



DETAIL 3

MULTIPLE GROUND WELL INSULATION

SCALE: 1 1/2"=1'-0"

NOTES:

1. SEE SHEET 2012-162-CD-10 FOR GENERAL NOTES
2. ELECTRICAL CONTRACTOR SHALL TEST ELECTRICAL GROUNDING SYSTEM & INSTALL ADD'L GROUND RODS AS NECESSARY TO MEET THE MOST STRINGENT OF PLANT, CITY, STATE AND FEDERAL (N.E.C.) CODES.

LEGEND

(N) = NEW

(E) = EXISTING

—S— = SANITARY SEWER

—W— = POTABLE WATER

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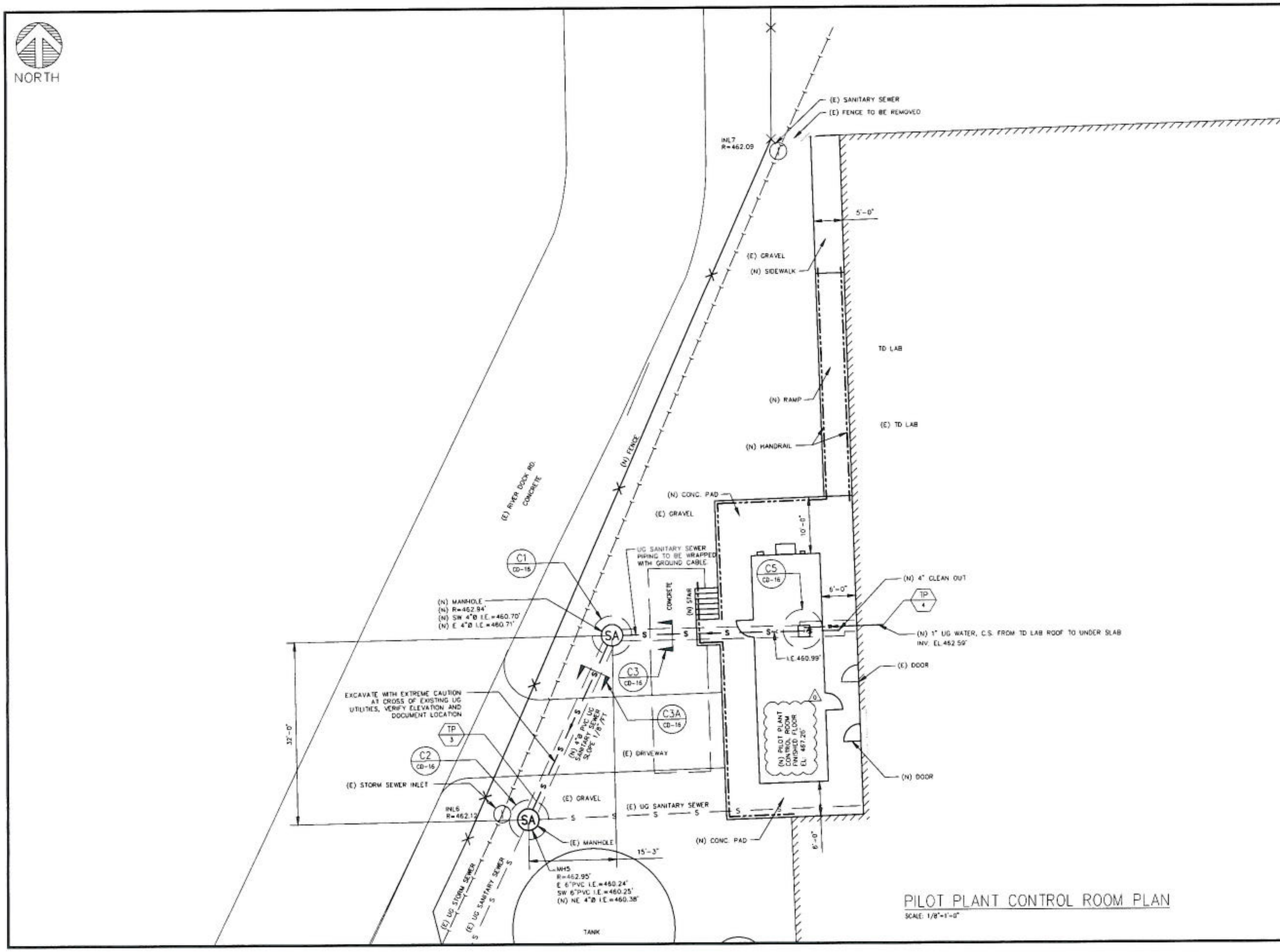
MARK	DATE	LIST OF REVISIONS	DRN.	APPD.
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn: DRB
Checked: RW
Approved: MT
Scale: 1/8" = 1'
Plot Scale: 1:1
Date: 9/25/12

FLINT HILLS RESOURCES
ELECTRICAL
GROUNDING PLAN & DETAILS
PILOT PLANT CONTROL ROOM

CAD File Name: 2012-162-ED-02.dwg
Dwg. No.: 2012-162-ED-02
Rev.: 0

FHRPRU001657



PILOT PLANT CONTROL ROOM PLAN

SCALE: 1/8"=1'-0"

LEGEND

(N) = NEW

(E) = EXISTING

—S— = SANITARY SEWER

—W— = POTABLE WATER

J.L. MEECE ENGINEERING, INC.
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(815) 634-2727 Fax (815) 634-2739

MARK	DATE	LIST OF REVISIONS	DRN	APPD
0	1/14/13	ISSUED FOR CONSTRUCTION	KS	RW

Drawn CJR
Checked RW
Approved MT
Scale 1/8" = 1'
Plot Scale 1:1
Date 9/20/12

FLINT HILLS RESOURCES
PIPING
UNDERGROUND PIPING PLAN
PILOT PLANT CONTROL ROOM

CAD File Name 2012-162-PD-02.dwg
Dwg No. 2012-162-PD-02
Rev. 0

1342 DRAWING INDEX

DRAWING NUMBER	DRAWING NAME	DATE:	REVISION
G-01	DRAWING INDEX	12/02/12	0
G-02	GENERAL SPECIFICATIONS	12/02/12	0
A-01	FLOOR PLAN	12/02/12	0
A-02	FLOOR PLAN DIMENSIONS	12/02/12	0
A-03	ARCHITECTURAL ELEVATIONS	12/02/12	0
A-04	CROSS SECTION DETAILS	12/02/12	0
A-05	ACCESSIBILITY ARCHITECTURAL DETAILS	12/02/12	0
A-06	CABINET DETAILS	12/02/12	0
S-01	STRUCTURAL FLOOR PLAN	12/02/12	0
S-02	STRUCTURAL ELEVATIONS	12/02/12	0
S-03	STRUCTURAL PENETRATION LOCATIONS	12/02/12	0
S-04	STRUCTURAL DETAILS	12/02/12	0
S-05	VENT PIPE DETAIL	12/02/12	0
S-06	GUTTER DETAILS	12/02/12	0
S-07	STRUCTURAL ROOF/ FLOOR FRAMING PLAN	12/02/12	0
S-08	STRUCTURAL FRAMING ELEVATIONS	12/02/12	0
S-09	STRUCTURAL WELDING DETAILS	12/02/12	0
P-01	PLUMBING LAYOUT DIMENSIONS	12/02/12	0
P-02	PLUMBING RISER DIAGRAMS	12/02/12	0
E-01	ELECTRICAL PANEL SCHEMATIC/ LOAD ANALYSIS/ LEGEND	12/02/12	0
E-02	ELECTRICAL POWER PLAN	12/02/12	0
E-03	ELECTRICAL LIGHTING PLAN	12/02/12	0
E-04	COMMUNICATIONS LAYOUT	12/02/12	0
E-05	REFLECTED CEILING PLAN	12/02/12	0
M-01	MECHANICAL DUCTWORK AND REGISTER LAYOUT	12/02/12	0
M-02	MECHANICAL DUCTWORK CROSS SECTIONS	12/02/12	0
M-03	MECHANICAL DUCTWORK DETAILS	12/02/12	0
M-04	MECHANICAL EQUIPMENT SCHEDULE AND DUCT DETAILS	12/02/12	0
M-05	AIR FLOW DIAGRAM, SCHEDULES AND SEQUENCE OF OPERATIONS	12/02/12	0

STRUCTURAL DESIGN CRITERIA

BLAST PRESSURE:	5.0 PSI FOR 200 MILLISECONDS
WIND DESIGN CONDITIONS	115 MPH, EXPOSURE "C"
WIND LOAD:	ASCE 7 (DETERMINED BY IBC 2012)
ROOF LIVE LOAD:	40 PSF
EARTHQUAKE:	ASCE 7 (DETERMINED BY IBC 2012)
SEISMIC DESIGN:	CATEGORY B
OCCUPANCY CATEGORY:	II
FLOOR LIVE LOAD: BUSINESS	75 PSF

DESIGN CODES
2012 INTERNATIONAL BUILDING CODE
2012 INTERNATIONAL PLUMBING CODE
2012 INTERNATIONAL MECHANICAL CODE
2011 NATIONAL ELECTRIC CODE

PROJECT NAME:	FLINT HILLS RESOURCES
PROJECT ADDRESS:	PERU IL.
PROJECT DESCRIPTION:	PILOT PLANT CONTROL ROOM
NEW BUILDING USE GROUP:	B=BUSINESS
ALLOWABLE SQ.FT.	B=480 SQ.FT.
NEW BLDG. CONST. TYPE	V-B
NEW BUILDING FLOOR AREA & USE	NEW FIRST FLOOR=480 SQ.FT.
AREA INCREASE FOR FRONTAGE:	NO
BUILDING FULLY SPRINKLED:	NO
AREA INCREASE FOR AUTO SPRINKLER	NO
ADA COMPLIANT	DUE TO BLAST RESISTANCE REQUIREMENTS, DOOR OPENING FORCE WILL EXCEED ADA CRITERIA
NEW USE GROUP B OCCUPANT LOAD;	480 SQ.FT. @ 100 SQ.FT. /PERSON=4 PERSON

NOTES:
1. BUILDING SET BACK: GREATER THAN 20' FROM COMMON OR ASSUMED PROPERTY LINE.
2. WHEN BOTTLED DRINKING WATER IS REQUIRED IT SHALL BE PROVIDED ON SITE BY OTHERS
3. WHEN SERVICE SINK IS REQUIRED IT SHALL BE PROVIDED ON SITE BY OTHERS.

ROBERT P. BILLS
081-006615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

HUNTER BUILDINGS & MANUFACTURING, LP

FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
DRAWING INDEX

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S.
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			G-01	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

FHRPRU001659

Design Parameters: The structure will be designed to withstand a 5.0-PSI Peak Free Field overpressure and a 200 millisecond duration with the criteria for ASCE "High Response" in accordance with ASCE 2010 Publication "Design of Blast Resistant Buildings in Petrochemical Facilities". Second Edition.
Size: 12' Wide x 40' Long x 11' 9" High (nominal) complete with the following features:

Qty	U/M	Description
		STEEL STRUCTURE:
		Base: Perimeter, HSS 6x6 tube, ASTM A500 Grade-B with HSS 6 x 2 joists @ 24" O.C.
		Columns: HSS 6 x 6 tube, ASTM A500 Grade-B.
		Roof: Perimeter, HSS 6 x 6 tube ASTM A500 Grade-B with C6 x 10.5 joists @ 24" O.C.
		Siding: 10 Gauge Plate, ASTM A1011-36 with 3 1/2" crimp profile
		Bottom: 12 Gauge Flat Plate, ASTM A1011-36.
		Roof: 12 Gauge Flat Plate, ASTM A1011-36.
4	EA	Top lifting padeyes each module
		Exterior finish as follows:
		• Commercial Blast
		• Prime coat of 2-4 mil epoxy
		• Top coat of 3-5 mil polyurethane, Color TBD
		Note: Paint color to match the maintenance building & guard house, per client's request previous job.
		FLOOR:
		Decking: Single layer of 1 1/8" plywood Sturd-I-Floor, installed perpendicular to the structural joist system.
		Floor Insulation: R-19 Kraft faced fiberglass and 1 1/2" semi-rigid insulation for thermal break. Combined R-25.2
		Vapor Barrier: 6 mil polyethylene
		Covering: VCT 1/8" x 12" x 12" commercial grade floor tile, Armstrong No. 51904 "TBD"
		Base: 4" vinyl cove base throughout, Color: "Dove Gray".
		PERIMETER INTERIOR WALLS:
		Framing: Steel studs, 6" x 20 gauge @ 16" O.C. and 20 gauge, formed top and bottom track, 7' 11" ceiling height.
		Wall Covering: 5/8" vinyl covered gypsum with matching battens, type X, "TBD".
		Wall Insulation: R-19 Kraft faced fiberglass.
		Vapor Barrier: 6 mil polyethylene
		PARTITION WALLS:
		Framing: Steel studs, 3 5/8" x 20 gauge @ 16" O.C. and 20 gauge formed top and bottom track, 7' 11" ceiling height.
		Wall Covering: 5/8" vinyl covered gypsum with matching battens, type X, "TBD".
		Interior Insulation: R-13 Kraft faced fiberglass.
		ROOF:
		Ceiling: Suspended acoustical, mineral fiber, fissure pattern, 2' x 2' grid, CertainTeed "Baroque".
		Roof Insulation: R-30, Rigid foam Owens Corning Formular 250 and 2" semi-rigid insulation board; combined R-38.7
		Sub Ceiling: 1/2" Gypsum
		Vapor Barrier: 6 mil polyethylene
		DOORS:
2	EA	Exterior: 36" x 80" Steel reinforced 5.0 PSI Blast Rated, with extra heavy duty hinges, keyed lever latchset, HD hydraulic door closer, panic push bar and drip cap. (Ergonomic Handle)
2	EA	Exterior Door Vision Panels: 7 1/2" x 7 1/2" 3/8" laminated safety glazing
2	EA	Nameplates: 4" x 6" engraved stainless steel mounted one at each exterior door
2	EA	Interior: 36" x 80", prefinished, solid core, metal frame
1	EA	Hardware: Privacy lever latchsets
2	EA	Hardware: Passage lever latchsets
		WINDOWS:
2	EA	Exterior: 36" x 30" 5.0 PSI rated, fixed non operable
		PLUMBING:
		Supply: Cross-linked polyethylene (PEX) piping c/w crimped fittings and shut offs at all fixtures
		DWV: PVC, Sch 40, multiple discharge points, External "MANIFOLDS BY OTHERS"
1	EA	Water Closets: Elongated tank type, rear discharge w/open front seat.
1	EA	Lavatory: 20" x 17" vitreous china in vanity base cabinet, plastic laminate top and surface finish, Color. "Dove Gray", with insulated supplies and trap.
1	EA	Sink: 25" x 22", single bowl, stainless steel, w/kitchen faucet
1	EA	Tankless Water Heater: Point of use, 240 Volt, Eemax SP55DL.
1	EA	Accessories: Single roll toilet tissue dispenser, chrome.
1	EA	Miscellaneous: External plumbing vent
1	EA	Miscellaneous: Water valve for client use.
1	EA	Miscellaneous: Water valve for refrigerator ice maker
1	EA	Floor Drains: 2" PVC w/ trap guard. Needs one hook-up in kitchen for water cooler.
		Note: Required plumbing fixtures are ADA compliant.
		ELECTRICAL:
0	~~EA~~	~~Service Entry Disconnect: 100 Amp non-fused, 480 Volt, 3 Ø, 4 wire, 60 hertz service. To be provided by Flint Hills Resources.~~
0	~~EA~~	~~Transformers: 30 kVA, floor mounted with std. taps above and below, for 480 Volt, 3 Ø, 3 wire delta primary and 208/120 volt 3 Ø, 4 wire wye secondary, mounted on building exterior, Square D No. EE30T3H. To be provided by Flint Hills Resources.~~
1	EA	Lighting Panelboard: 100 Amp main breaker, 27 Circuit, NEMA 1 flush mounted, 208/120 Volt, 3 Ø, 4 wire, 60 hertz service
		Raceway: #12-AWG (minimum) THHN, copper, in Type MC raceway with full ground, concealed.
		ELECTRICAL: (Continued)
7	EA	Lighting: Fluorescent, 2' x 4', two (2) tube lay-in troffers, 32 Watt T-8 lamps, electronic dimming ballasts and acrylic diffuser
1	EA	Lighting: Fluorescent, 2' x 2', two (2) tube lay-in troffers, 17 Watt T-8 lamps, electronic dimming ballasts and acrylic diffuser
2	EA	Lighting: Exterior weather resistant 150W LED
1	EA	Photo Cell: Exterior weather resistant, rated for Class 1 Division 2 locations
0	~~EA~~	~~Lighting: Exterior weather resistant 60W incandescent located on each corner of the building.~~
2	EA	Lighting: Emergency/Exit combination, incandescent dual head lamps, lead-calcium 90 minute battery backup
21	EA	Receptacles: NEMA 5-20R, 120 Volt, 20 Amp, duplex with white cover plate
2	EA	Receptacles: NEMA 5-20R, 120 Volt, 20 Amp, GFCI duplex with white cover plate
		Note: All wall mounted convenience receptacles, except at counter tops, to be mounted at 18" AFF.
1	EA	Receptacle: NEMA 5-20R, 120 Volt, 20 Amp, mounted adjacent to HVAC systems. GFCI
1	EA	Water Heater Receptacle: NEMA L6-30R, 120 Volt, 30 Amp, single, with stainless steel cover plate
6	EA	Switches: Single pole toggle, 120 Volt, 20 Amp, with white cover plate
2	EA	Switches: Three way toggle, 120 Volt, 20Amp, with white cover plate.
		All switches to be mounted at 48" AFF.
14	EA	Data/Phone boxes: 4" x 4" junction boxes w/3/4" EMT stubbed into the ceiling cavity, Mounted @ 18" AFF.
5	EA	Junction Box: 4" x 4" w/3/4" EMT stubbed into the ceiling cavity, for client provided and install fire protection equipment, Mounted @ 80" AFF or as noted.
2	EA	Grounding: 3" x 3" x 1/4" stainless steel pads welded to opposite corners for field connection for client grounding lugs.
		COMMUNICATIONS:
14	EA	Modtap RJ45-568B duplex jacks each with (1) jack for voice and (1) jacks for LAN wired with CAT 5e plenum rated cable
1	EA	Exterior Pull Box w/backplate, NEMA 4, 6"x6"x4"
~~1~~	~~EA~~	~~Interior Communications Box~~
		FIRE DETECTION/PROTECTION:
0	~~EA~~	~~Smoke Detectors: 120 Volt with audible alarm and battery back up.~~
0	~~EA~~	~~Strobes: Multi Candela, indoor wall mounted @ 80" AFF, Cooper/Wheelock Series ZRS-24MCW-FR.~~
		~~Note: Client to specify location where wire will be pulled and coiled. Final terminations @ site by others.~~
0	~~EA~~	~~Smoke Detector Relays: To shut down HVAC unit and exhaust fan.~~
2	EA	Fire Extinguishers: UL 3A-40B:C Badger No. 22435 with Amerex No. 807 wall bracket
		HVAC:
0	~~EA~~	~~Central A.C./Heat: 36,000 (nominal) BTU/10 kW electric heat, self contained, wall mounted with unclassified electrical condenser section.~~
		~~System designed for 208-230 Volt 1Ø, 60 Hz. Electrical service.~~
		~~Unit includes the following features:~~
		~~• R-410A Refrigerant~~
		~~• Integral exterior disconnect~~
		~~• Barometric Fresh Air Damper~~
1	EA	Thermostat: Programmable, mounted @ 60" AFF, Honeywell TH6220D-002.
2	EA	Blast Dampers: Located at HVAC openings, Enertech series ICBL (or equal) size according to opening
1	Lot	Supply Duct: Galvanized and insulated main trunk with flex drops to 2' x 2' high volume adjustable lay-in supply registers. Designed in accordance with SMACNA low pressure duct standards.
		Return: Via ceiling plenum
2	EA	Exhaust Fan: 100 CFM, ceiling mounted and exhausted to exterior, Broan 684.
		GAS DETECTION: (None Provided)
		FURNISHINGS/EQUIPMENT:
9	LF	Work Station Desk Top: 30" deep plastic laminate over plywood substrate, Color" Dove Gray"
5	LF	Work Station Cabinets: Plywood Substrate with plastic laminate surface finish, Color: "Dove Gray". TBD
4.5	LF	Kitchen Base Cabinets: Plywood Substrate with laminate surface finish with plastic laminate top, and utensil drawers, Color: "Dove Gray". TBD
9.5	LF	Kitchen Wall Cabinets: Plywood Substrate with plastic laminate surface finish, Color: "Dove Gray". TBD
0	~~LF~~	~~Book Shelf: 12" deep plastic laminate top and bottom over plywood substrate, Color" Dove Gray"~~

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081-006815
LICENSED
STRUCTURAL
ENGINEER
STATE OF ILLINOIS
12/5/12

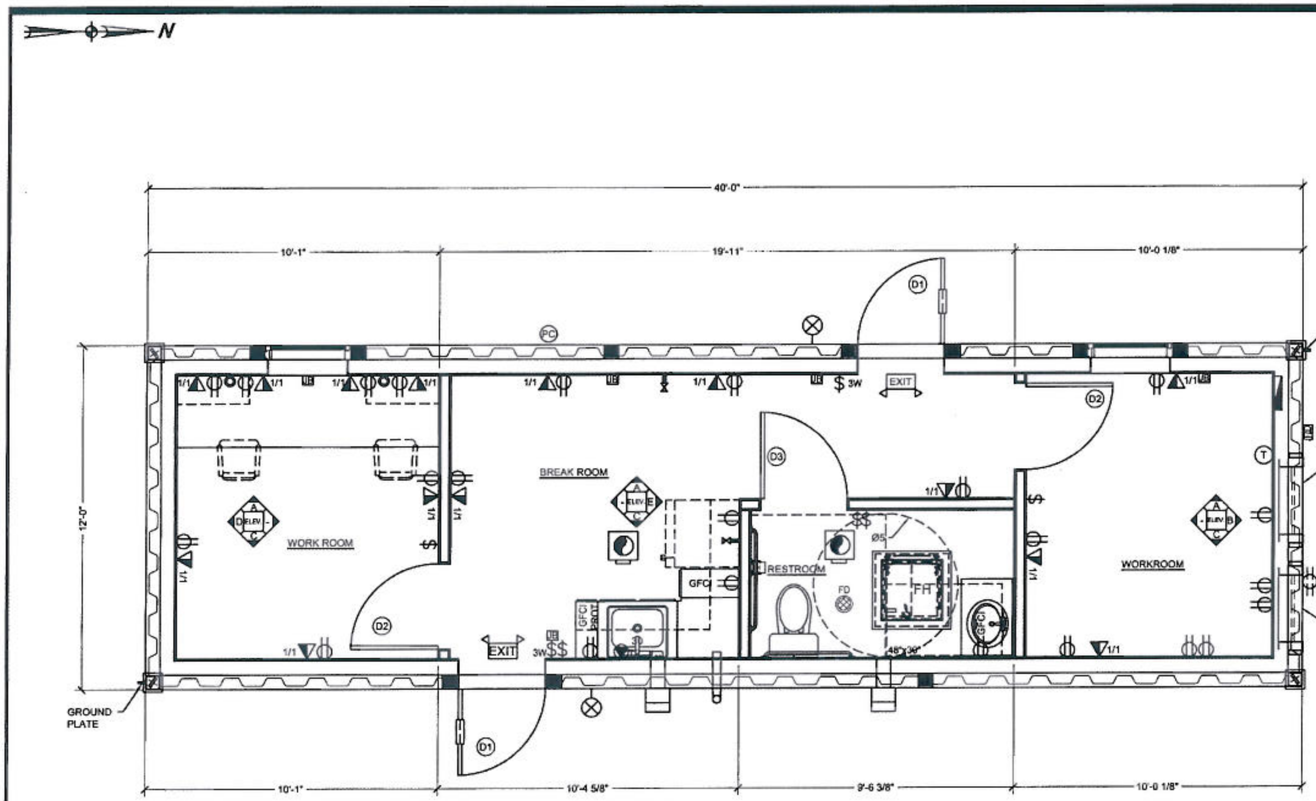
NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

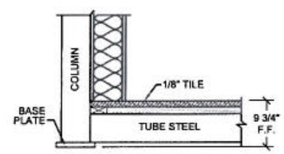
FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
GENERAL SPECIFICATIONS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S.
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			G-02	REV 0



LEGEND:

- FLUORESCENT 2X4 LAY IN 2 TUBE
- FLUORESCENT 2X2 LAY IN 2 TUBE
- EXIT/EMERGENCY LIGHT WITH BATTERY BACK-UP
- EXTERIOR COMMUNICATIONS JUNCTION BOX NEMA 4
- EXTERIOR LIGHT, 150W LED
- DUPLEX RECEPTACLE, 120V, 20 AMP
- GFCI WEATHER PROOF RECEPTACLE, 20 AMP
- GFCI DUPLEX RECEPTACLE 120V, 20 AMP
- 30 AMP TWIST/LOCK RECEPTACLE
- SWITCH SINGLE POLE, 120V, 20 AMP
- THREE WAY SWITCH, 120V, 20 AMP
- VOICE/ DATA DUPLEX JACK, 1 VOICE/ 1 DATA RJ45-568 A/B
- LOAD CENTER
- THERMOSTAT
- EXHAUST FAN
- VENT WITH BIRD SCREEN
- PLUMBING VENT PIPE
- PHOTO CELL
- J-BOX FOR CLIENT PROVIDED AND INSTALL FIRE PROTECTTION EQUIPMENT



TYP. FINISH FLOOR DETAIL

NOTES:
1. ALL INTERIOR DIMENSIONS ARE TO FACE OF GYP.
2. SEE DRAWING A-03 FOR DOOR SCHEDULE.

Robert P. Bills
ROBERT P. BILLS
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STATE OF ILLINOIS
12/5/12

HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
FLOOR PLAN

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	1/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:				A-01

REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

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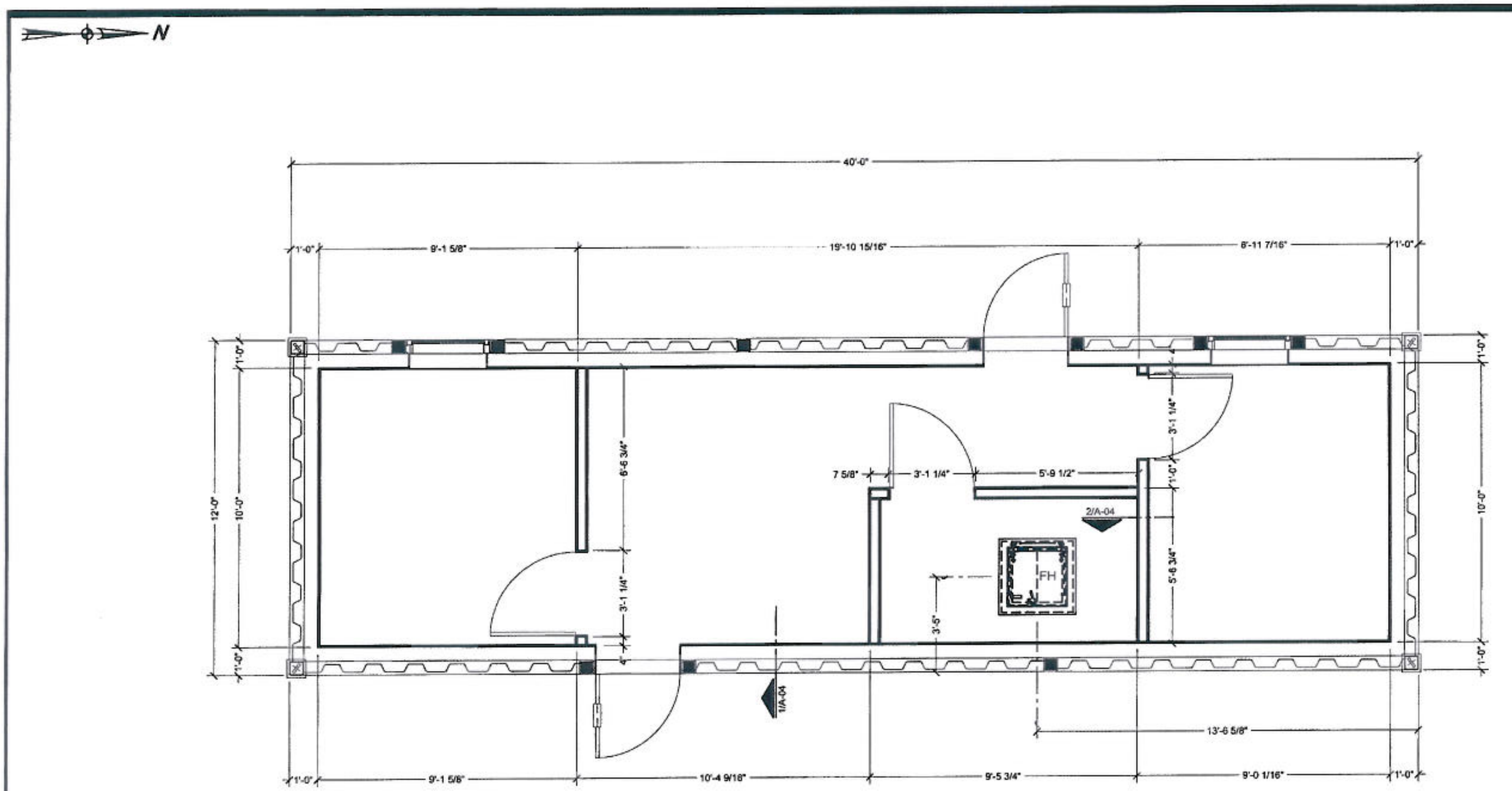

ROBERT P. BILLS
081-006615
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ENGINEER
STATE OF ILLINOIS
12/5/12

NOTES:
1. ALL INTERIOR DIMENSIONS ARE TO METAL STUDS.
2. SEE DRAWING A-04 FOR SECTION VIEWS 1-1, 2-2.

HUNTER

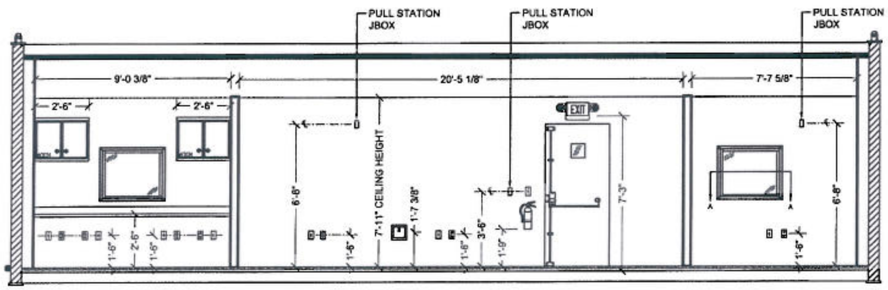
FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
FLOOR PLAN DIMENSIONS

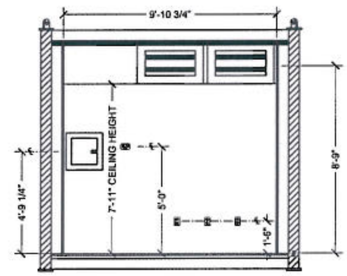
	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	1/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			A-02	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

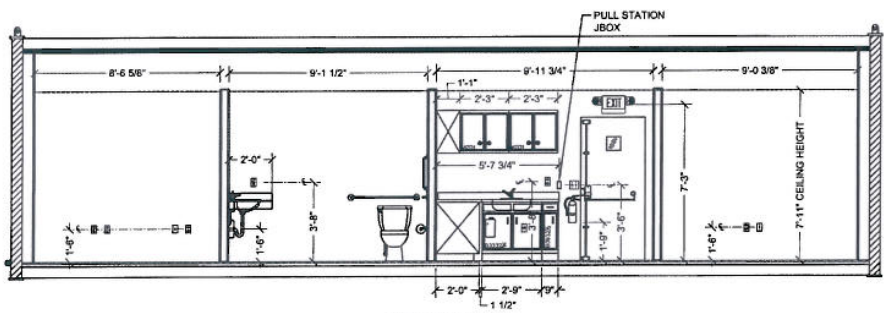
FHRPRU001662



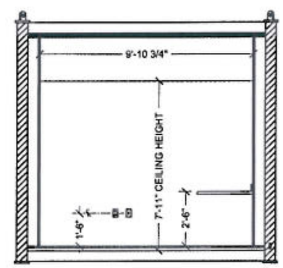
ELEVATION "A"
REFERENCE DRAWING
A-01



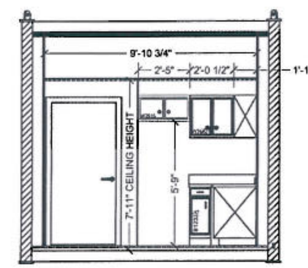
ELEVATION "B"
REFERENCE DRAWING
A-01



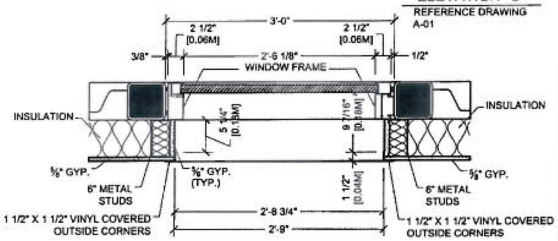
ELEVATION "C"
REFERENCE DRAWING
A-01



ELEVATION "D"
REFERENCE DRAWING
A-01



ELEVATION "E"
REFERENCE DRAWING
A-01



SECTION A-A
TYP. FOR ALL WINDOWS

1342 CONTROL ROOM DOOR SCHEDULE		
TYPE	DESCRIPTION	QTY.
D1	EXTERIOR 36"x80" STEEL REINFORCED 5.0 PSI BLAST RATED, WITH EXTRA HEAVY DUTY HINGES, KEYED LEVER LATCH SET, HD HYDRAULIC DOOR CLOSER, PANIC PUSH BAR, DRIP CAP AND 7 1/2" x 7 1/2" x 3/8" VISION PANEL.	2
D2	INTERIOR 36"x80" PREFINISHED, SOLID CORE, METAL FRAME, WITH PASSAGE LEVER LATCH SET.	2
D3	INTERIOR 36"x80" PREFINISHED, SOLID CORE, METAL FRAME, WITH PRIVACY LEVER LATCH SET.	1

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FLINT HILLS
RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
ARCHITECTURAL ELEVATIONS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			A-03	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
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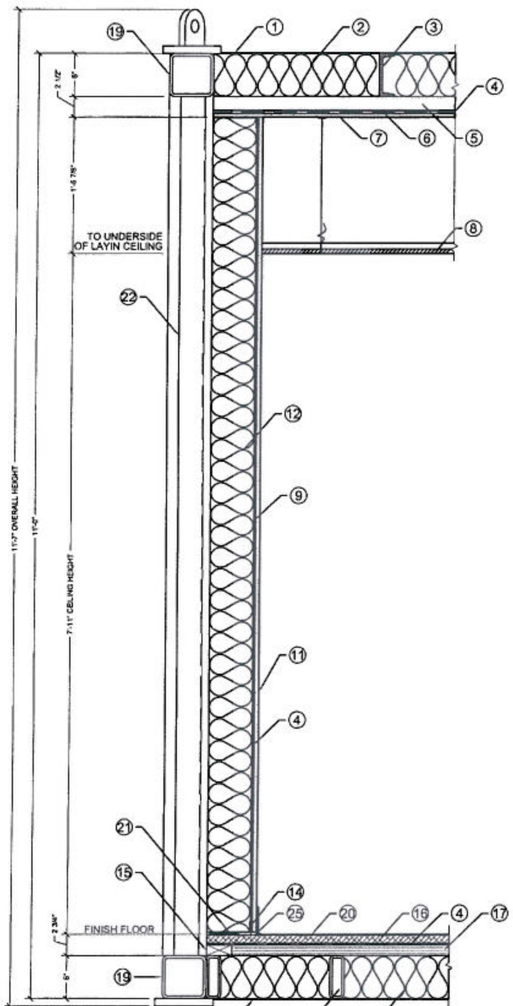
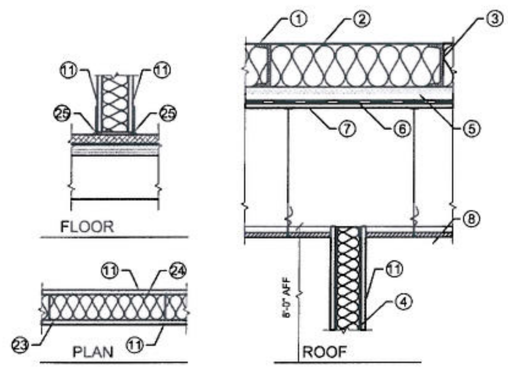
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD



TYPICAL WALL TO FLOOR DETAIL 1-1
SCALE: N.T.S



TYPICAL INTERIOR PARTITION 2-2
SCALE: N.T.S
REFERENCE DRAWING: A-02

1342 TYP. INTERIOR/EXTERIOR WALL CALLOUT	
NO.	DESCRIPTION
1	ROOF STEEL PLATE
2	R19 FIBERGLASS INSULATION TIGHT FIT
3	CHANNEL ROOF JOIST AT 2'-0" O.C.
4	POLYETHYLENE VAPOR BARRIER
5	2" FIBERGLASS SEMI-RIGID INSULATION BETWEEN ANGLES
6	(2) ANGLE BARS @ 24" O.C.
7	TYPE "X" GYPSUM BOARD SUBCEILING
8	LAYIN CEILING
9	6" STEEL STUDS AT 16" O.C.
11	5/8" VINYL FACED TYPE "X" GYPSUM BOARD
12	R19 KRAFT FACED FIBERGLASS INSULATION, SECURED TO STEEL STUDS
13	FLOOR STEEL PLATE
14	SEAL VAPOR BARRIER TO STEEL TRACK WITH ACOUSTICAL CAULKING
15	2X4 WOOD SLEEPER SCREWED TO FLOOR STEEL JOIST
16	PLYWOOD SUBFLOOR
17	1 1/2" FIBERGLASS SEMI-RIGID INSULATION
18	HSS FLOOR JOISTS
19	HSS
20	FINISH FLOOR, 12"x12"x1/8" VCT
21	SEAL SILL GASKET TO PLYWOOD AND UNDER STEEL STUD TRACK WITH ACOUSTICAL CAULKING
22	CORRUGATED EXTERIOR METAL SKIN
23	3 5/8" STEEL STUDS AT 16" O.C.
24	3 5/8" R13 KRAFT FACED FIBERGLASS INSULATION, SECURED TO STEEL STUDS
25	COVE BASE

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
CROSS SECTION DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			A-04	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
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-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

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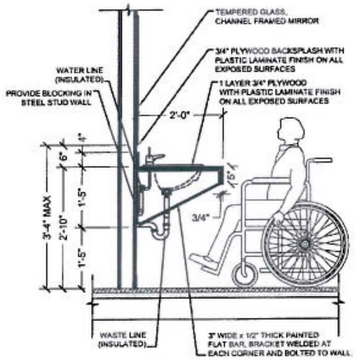
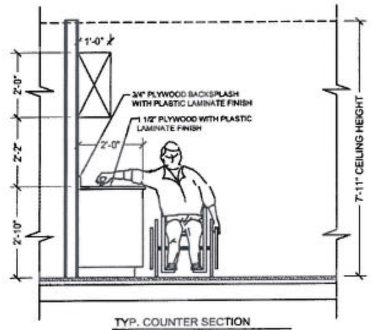
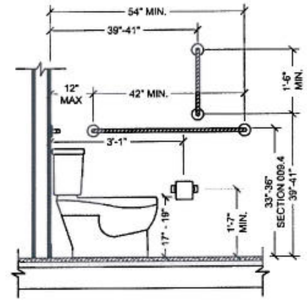


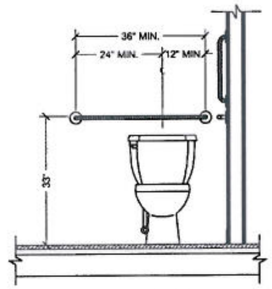
TYP. LAVATORY SECTION
NTS



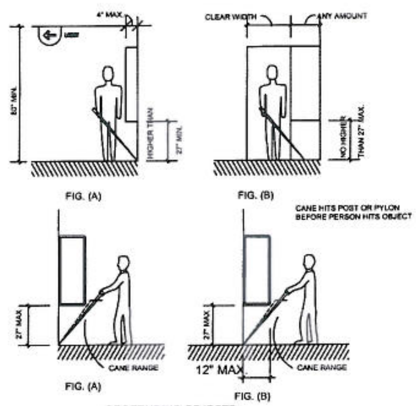
TYP. COUNTER SECTION
NTS



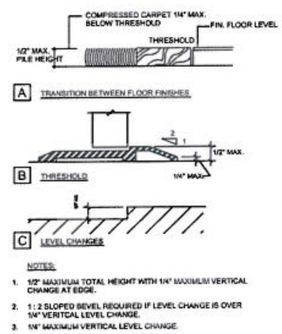
TYP. GRAB BAR DETAIL 1
NTS



TYP. GRAB BAR DETAIL 2
NTS



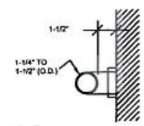
PROTRUDING OBJECTS
NTS



NOTES:

1. 1/2" MAXIMUM TOTAL HEIGHT WITH 1/4" MAXIMUM VERTICAL CHANGE AT EDGE.
2. 1 : 2 SLOPED BEVEL REQUIRED IF LEVEL CHANGE IS OVER 1/4" VERITCAL LEVEL CHANGE.
3. 1/4" MAXIMUM VERTICAL LEVEL CHANGE.

THRESHOLD/ LEVEL CHANGES
NTS



GRAB BAR
NTS

ROBERT F. BILLS
081-006615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

HUNTER BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
ACCESSIBILITY ARCHITECTURAL DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:				A-05

REV A

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
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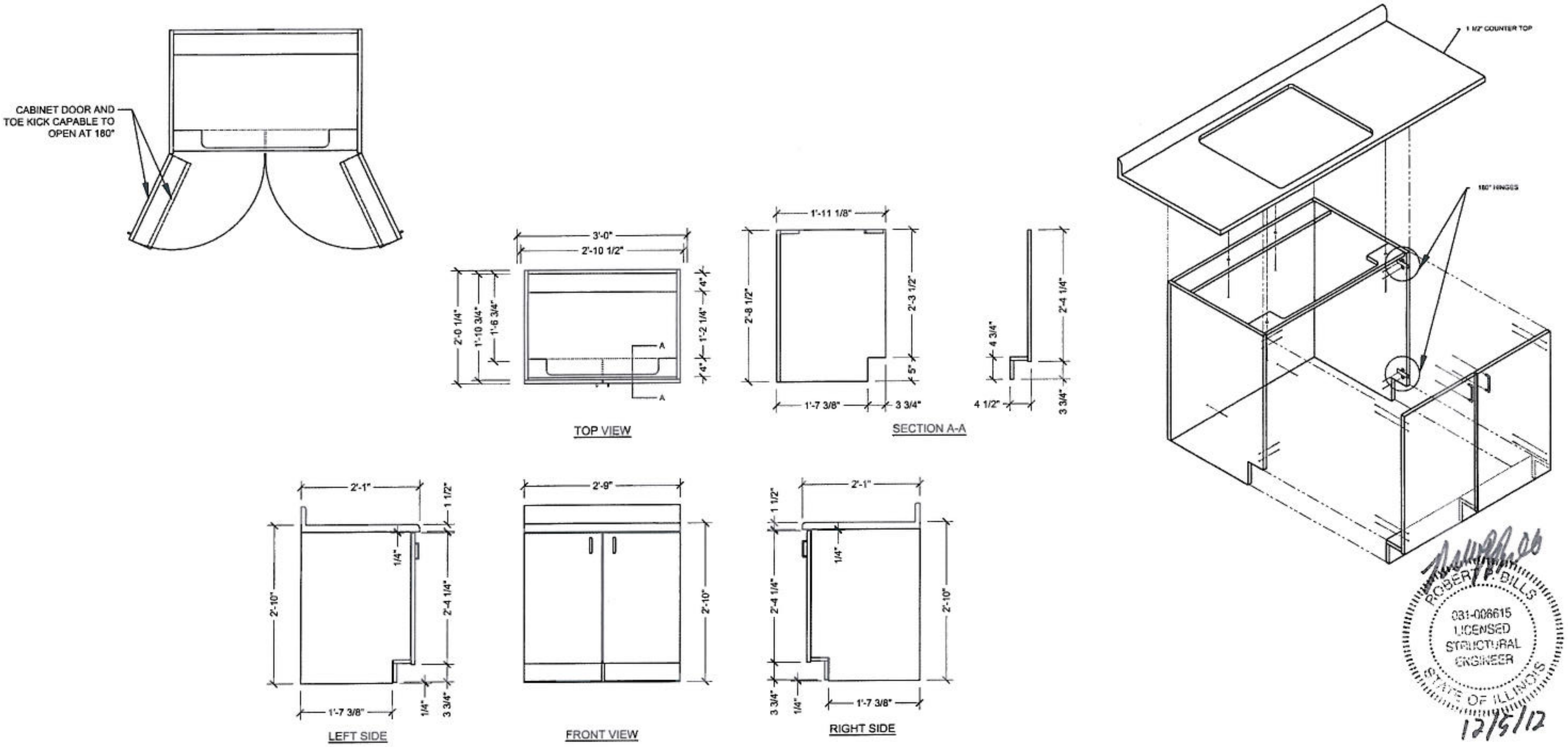
-	-	-	-	-	A	11/02/12	ISSUED FOR APPROVAL	LM	JD

FHRPRU001665



HUNTER

BUILDINGS & MANUFACTURING, LP

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
CABINET DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			A-06	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
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-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

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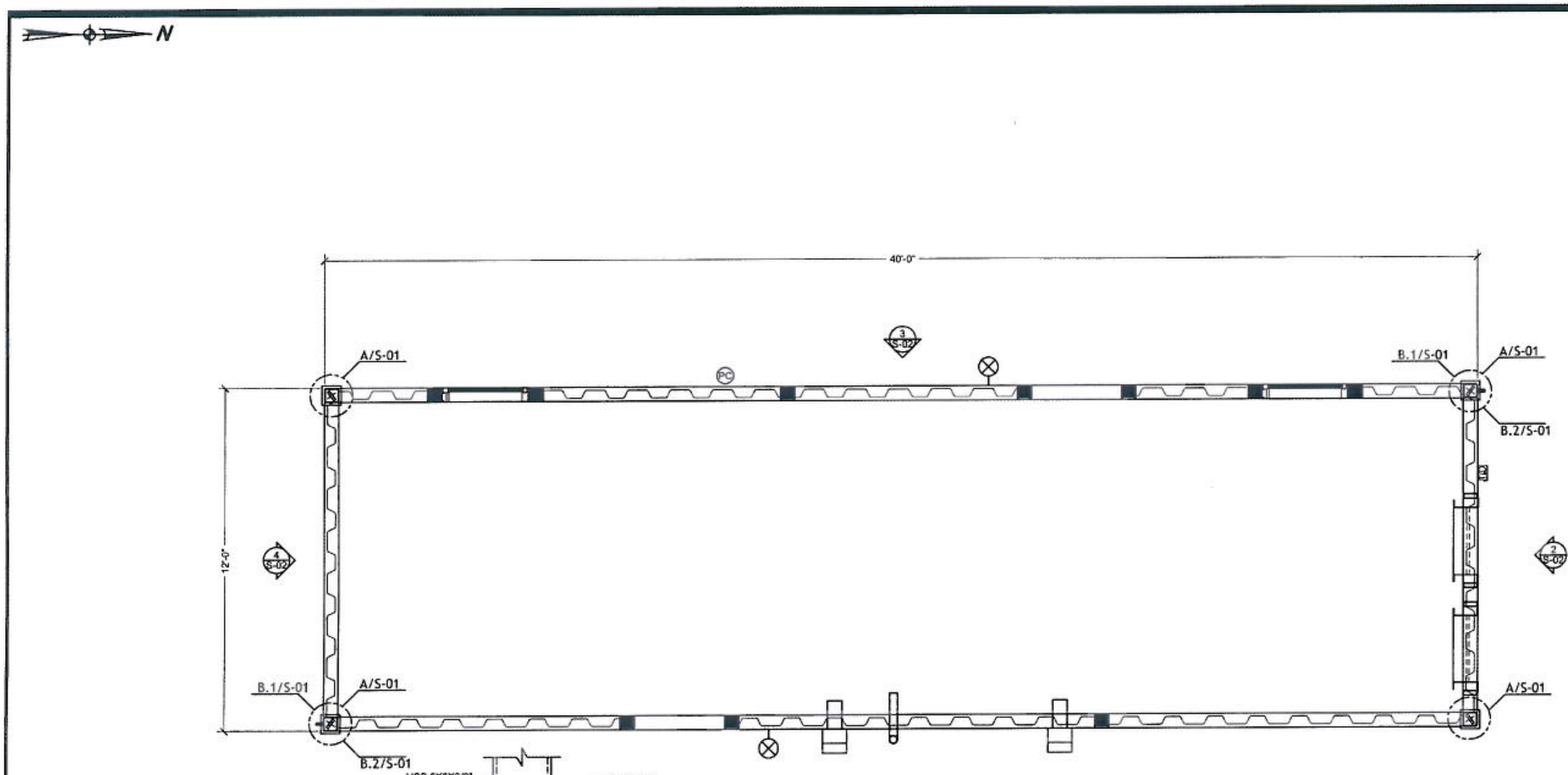

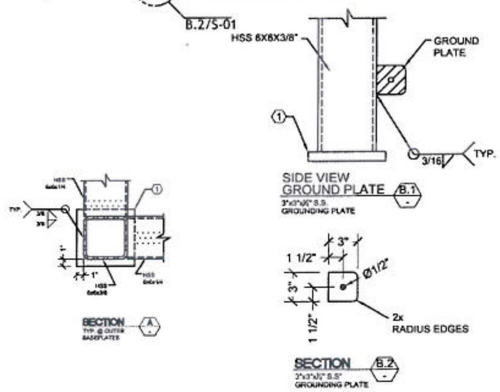

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.
5. CIRCLES SHOWN AT COLUMN LOCATIONS INDICATE LOAD BEARING POINTS AND BASE PLATE LOCATIONS.
6. SEE S-03 FOR PENETRATION LOCATIONS.

MODULE WEIGHT		
MODULE	CALCULATED WEIGHT	UNITS
A	35,739.74	Lbs.
TOTAL	35,739.74	Lbs.

ROBERT P. BILLS
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STATE OF ILLINOIS
12/5/12

HUNTER
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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL FLOOR PLAN

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	1/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-01	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

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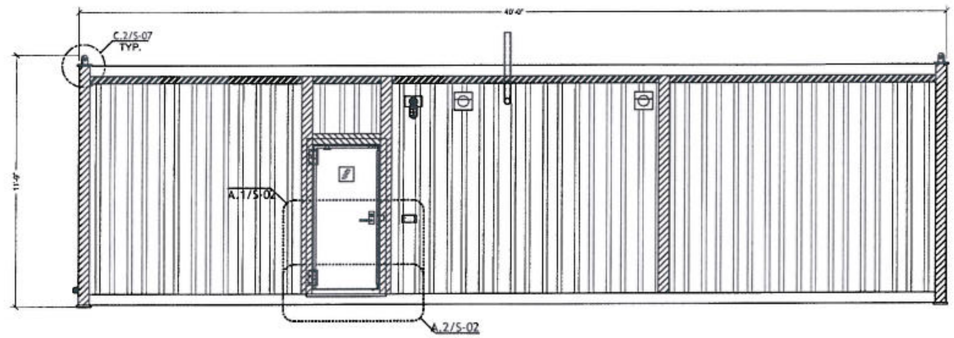
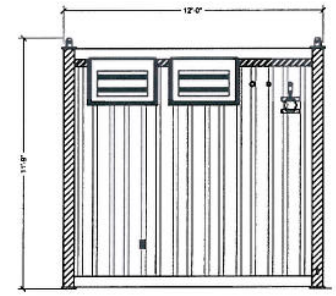


ELEVATION 3
REF. DRAWING S-01



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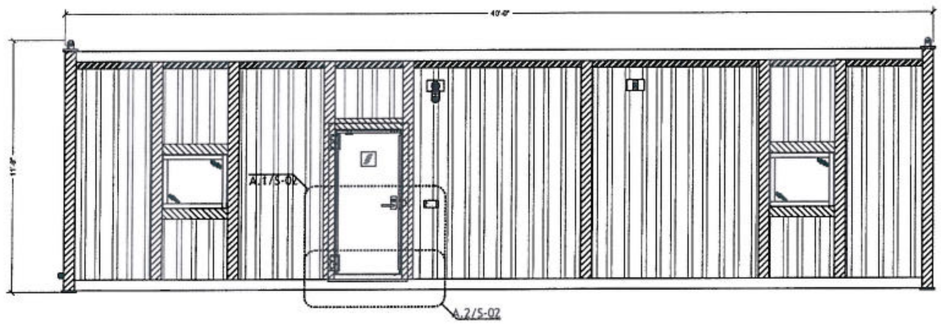
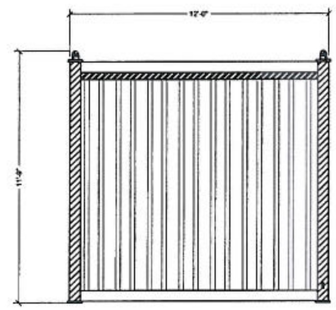
REF. DRAWING S-01



ELEVATION 1
REF. DRAWING S-01



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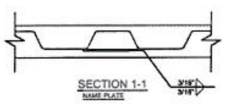
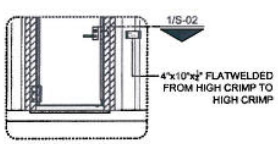
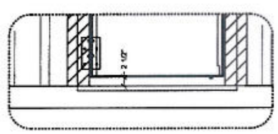
REF. DRAWING S-01



SECTION 1-1
NAME PLATE



NAME PLATE DETAIL A.1 S-02
(TYPICAL @ ALL EXTERIOR DOORS)



BOTTOM DOOR DETAIL A.2 S-02
(TYPICAL @ ALL EXTERIOR DOORS)

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.

ROBERT P. BILLS
081-006615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

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-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

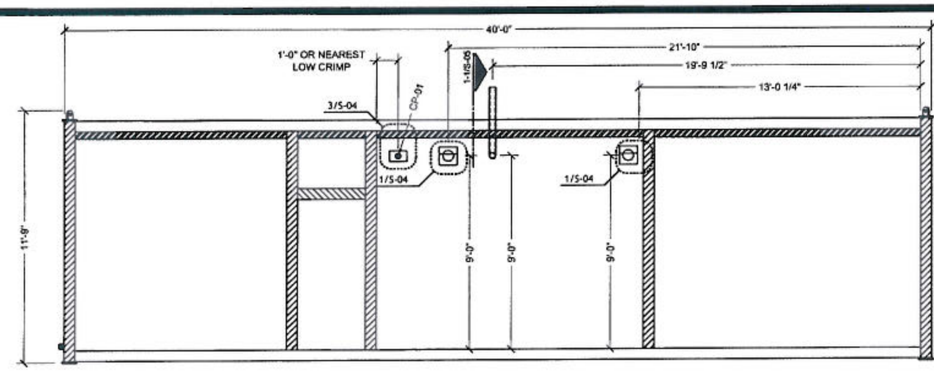
HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

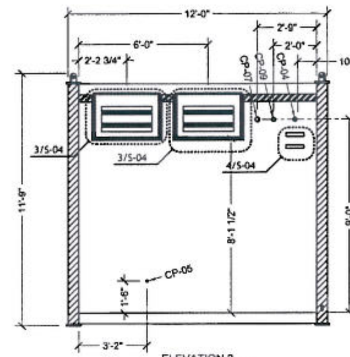
FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL ELEVATIONS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-02	REV 0

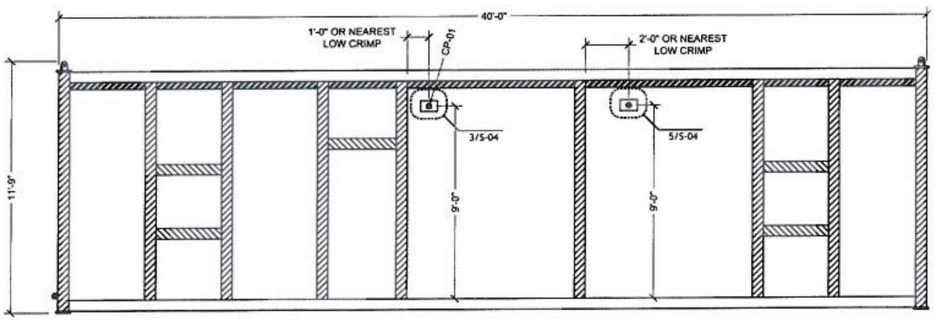
FHRPRU001668



ELEVATION 3
REF. DRAWING S-01



ELEVATION 2
REF. DRAWING S-01



ELEVATION 1
REF. DRAWING S-01

ROBERT R. BILLS
081-006615
LICENSED
STRUCTURAL
ENGINEER
STATE OF ILLINOIS
12/5/12

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.
5. SEE DRAWING S-04 FOR DETAILS.

COUPLING SCHEDULE

NO.	DESCRIPTION	QTY.	SIZE
CP-01	STEEL COUPLING FOR EXTERIOR LIGHT	2	Ø3/4"
CP-02	STAINLESS STEEL COUPLING FOR DRAIN	1	Ø2"
CP-03	STAINLESS STEEL COUPLING FOR WATER INLET	1	Ø1"
CP-04	STEEL COUPLING FOR COMMUNICATIONS BOX	1	Ø1 1/2"
CP-05	STEEL COUPLING FOR EXTERIOR RECEPTACLES	1	Ø3/4"
CP-06	STAINLESS STEEL COUPLING FOR DRAIN	1	Ø3"
CP-07	STEEL COUPLING FOR DISCONNECT	1	Ø2"
CP-08	STEEL COUPLING FOR PHOTOCELL	1	Ø3/4"
CP-09	STEEL COUPLING FOR CLIENT USE	1	Ø1 1/2"

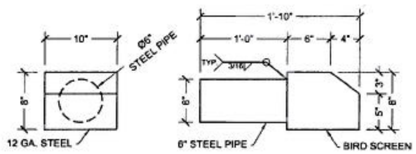
NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

HUNTER
BUILDINGS & MANUFACTURING, LP

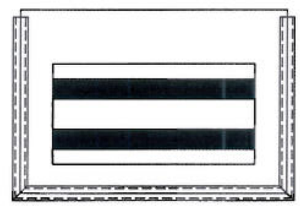
FLINT HILLS RESOURCES

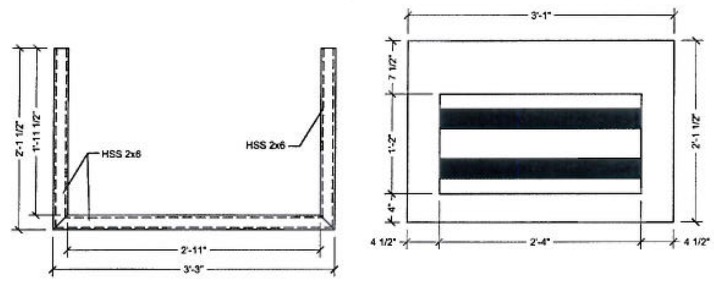
FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL PENETRATION LOCATIONS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-03	REV 0

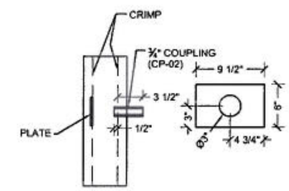


DETAIL 1
VENT PIPE DETAIL

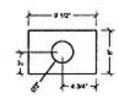




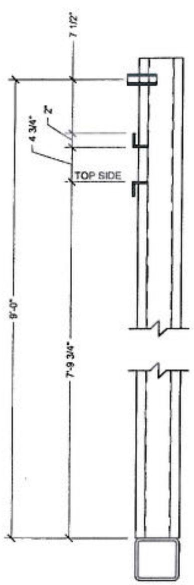
DETAIL 2
BLAST DAMPER
DTL. QTY.2

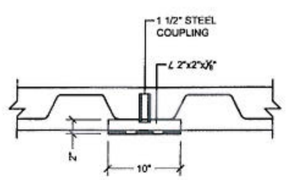


DETAIL 3
EXTERIOR LIGHT BRACKET
REF. DRAWING S-03



DETAIL 4
PHOTOCELL MOUNTING BRACKET





DETAIL 5
EXTERIOR COMM. BOX
MOUNTING ANGLE QTY. 2

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.

ROBERT E. MILLS
081-006615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

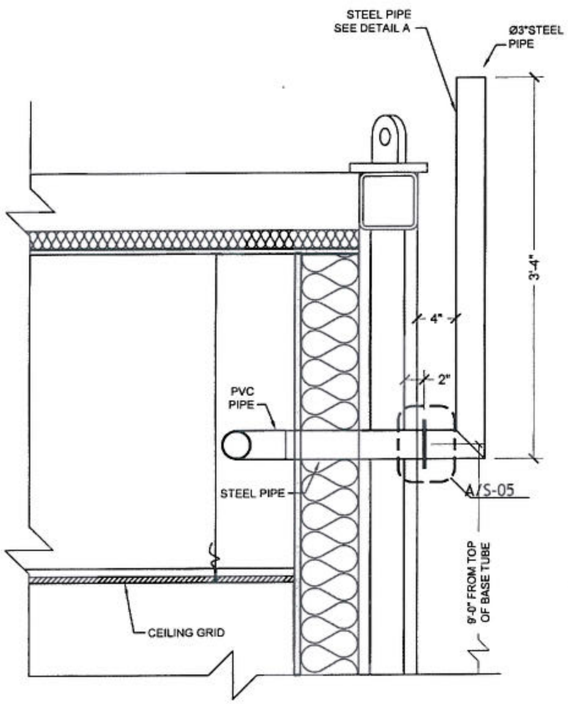
HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

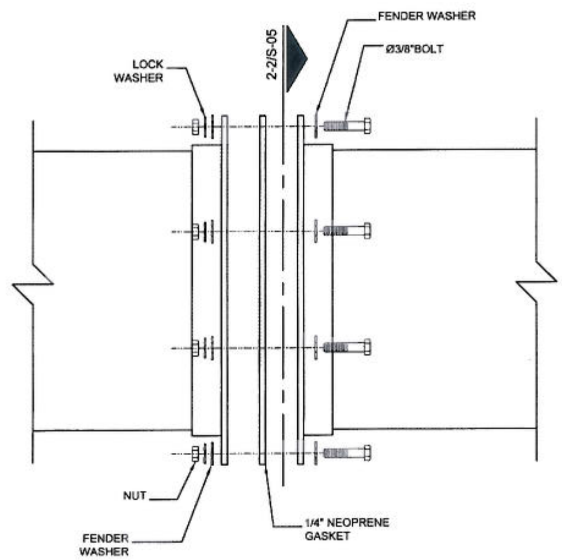
FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-04	REV 0

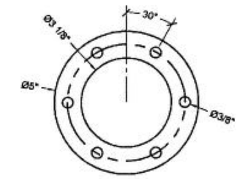
NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD



SECTION 1-1
VENT PIPE
REF. DRAWING S-02



DETAIL A
CONNECTION DETAIL



SECTION 2-2
FLANGE ELEVATION

ROBERT H. BILLS
081-006615
LICENSED
STRUCTURAL
ENGINEER
STATE OF ILLINOIS
12/5/12

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.

HUNTER
BUILDINGS & MANUFACTURING, LP

FLINT HILLS
RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
VENT PIPE DETAIL

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-05	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
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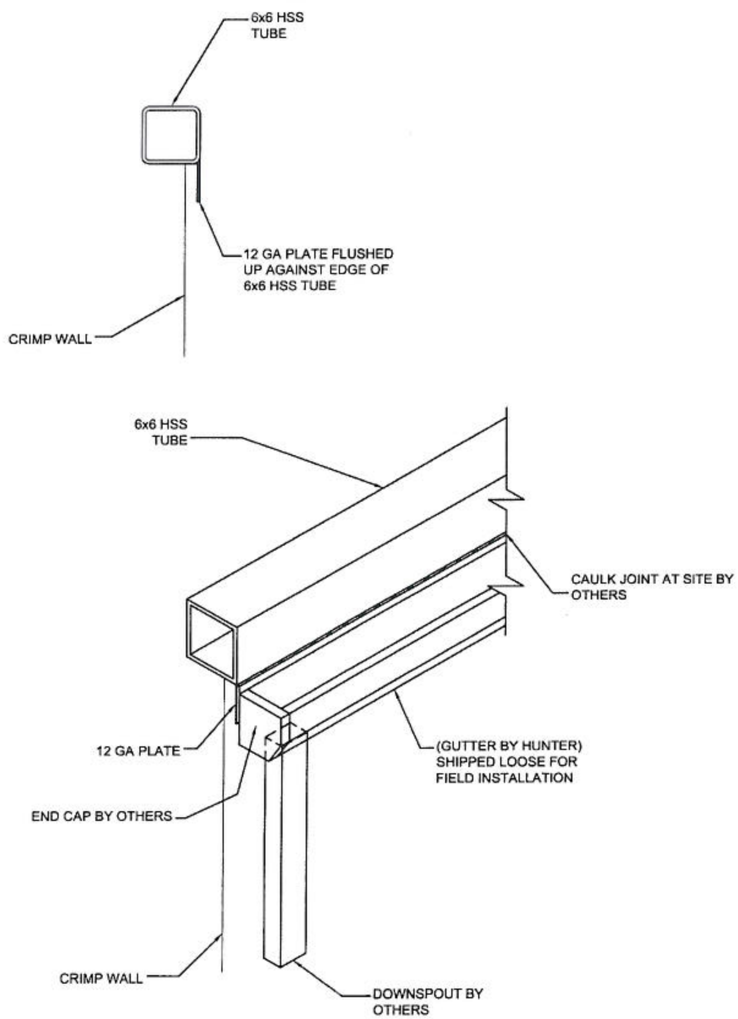
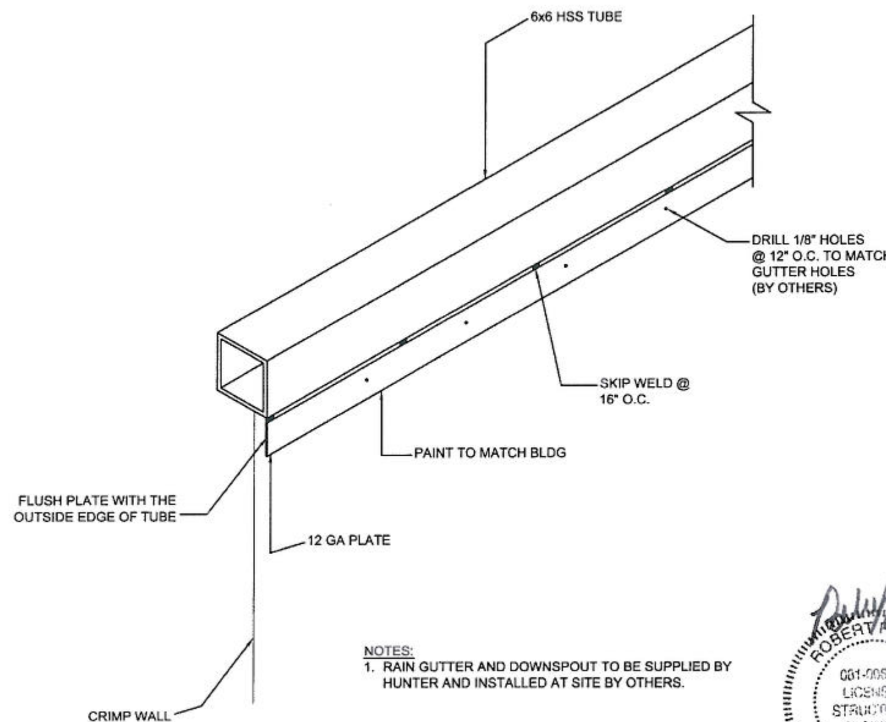
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD





NOTES:
1. RAIN GUTTER AND DOWNSPOUT TO BE SUPPLIED BY HUNTER AND INSTALLED AT SITE BY OTHERS.

ROBERT P. BILLS
081-005615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

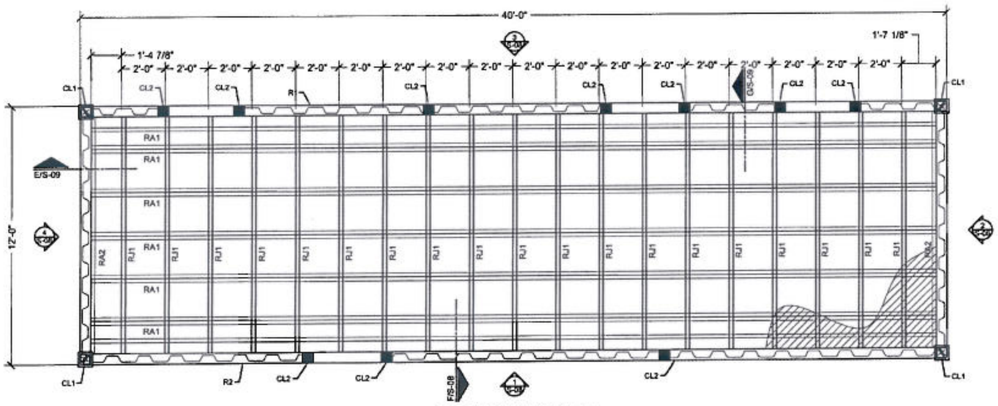
HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

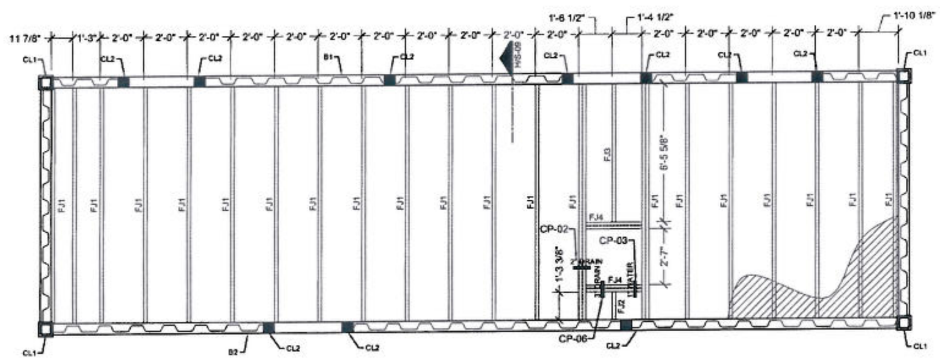
FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
GUTTER DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	NTS
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-06	REV 0

N



ROOF FRAMING PLAN



FLOOR FRAMING PLAN

COUPLING SCHEDULE			
NO.	DESCRIPTION	QTY.	SIZE
CP-01	STEEL COUPLING FOR EXTERIOR LIGHT	2	Ø3/4"
CP-02	STAINLESS STEEL COUPLING FOR DRAIN	1	Ø2"
CP-03	STAINLESS STEEL COUPLING FOR WATER INLET	1	Ø1"
CP-04	STEEL COUPLING FOR COMMUNICATIONS BOX	1	Ø1 1/2"
CP-05	STEEL COUPLING FOR EXTERIOR RECEPTACLES	1	Ø3/4"
CP-06	STAINLESS STEEL COUPLING FOR DRAIN	1	Ø3"
CP-07	STEEL COUPLING FOR DISCONNECT	1	Ø2"
CP-08	STEEL COUPLING FOR PHOTOCELL	1	Ø3/4"
CP-09	STEEL COUPLING FOR CLIENT USE	1	Ø1 1/2"

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.

ROBERT P. BILLS
031-006615
LICENSED
STRUCTURAL
ENGINEER
STATE OF ILLINOIS
12/5/12

HUNTER
BUILDINGS & MANUFACTURING, LP

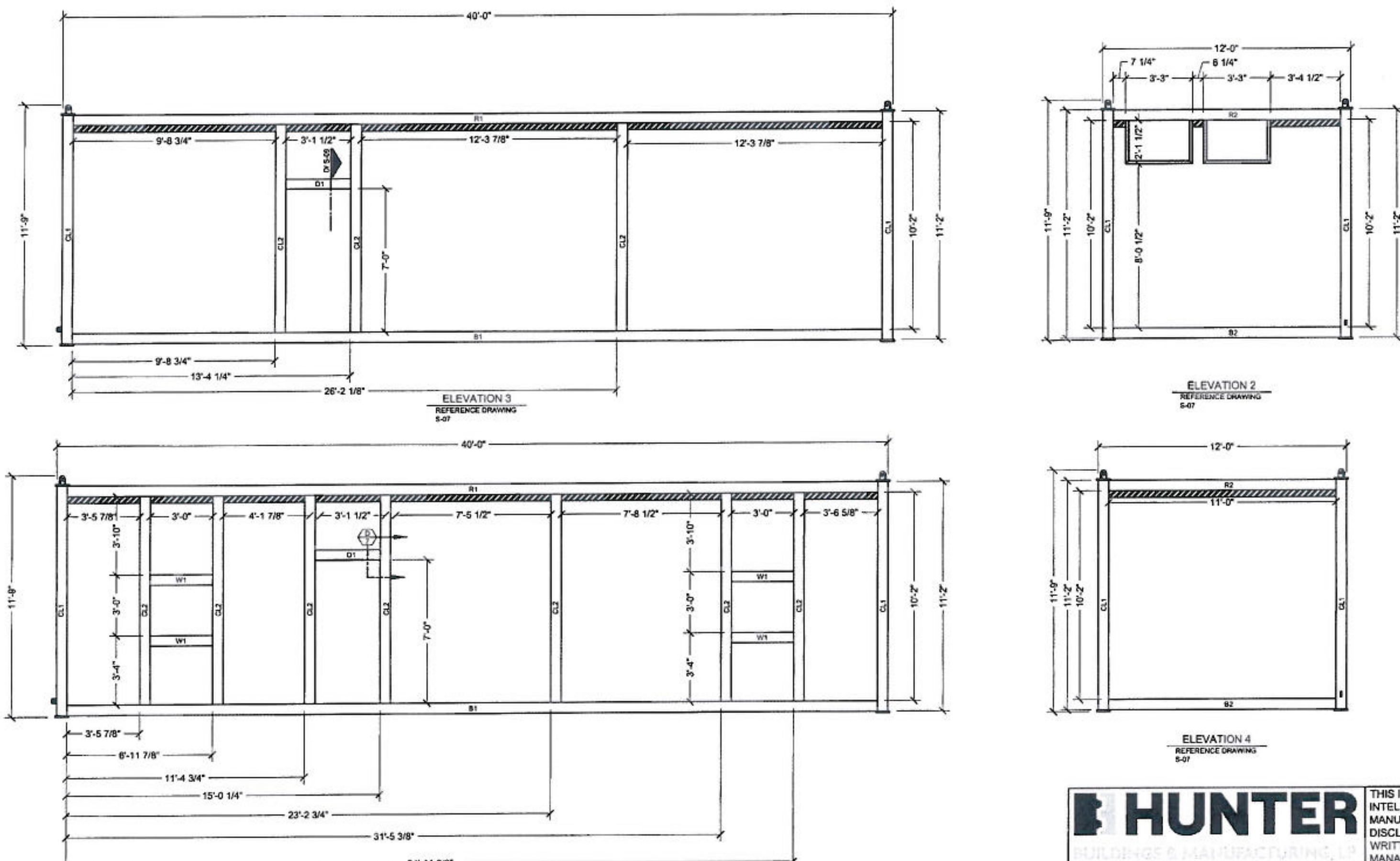
FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL ROOF/ FLOOR FRAMING PLAN

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-07	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

FHRPRU001673



ELEVATION 1
REFERENCE DRAWING
S-07

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.
5. SEE DRAWING S-03 FOR DETAILS.

ROBERT P. BILLS
081-006615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

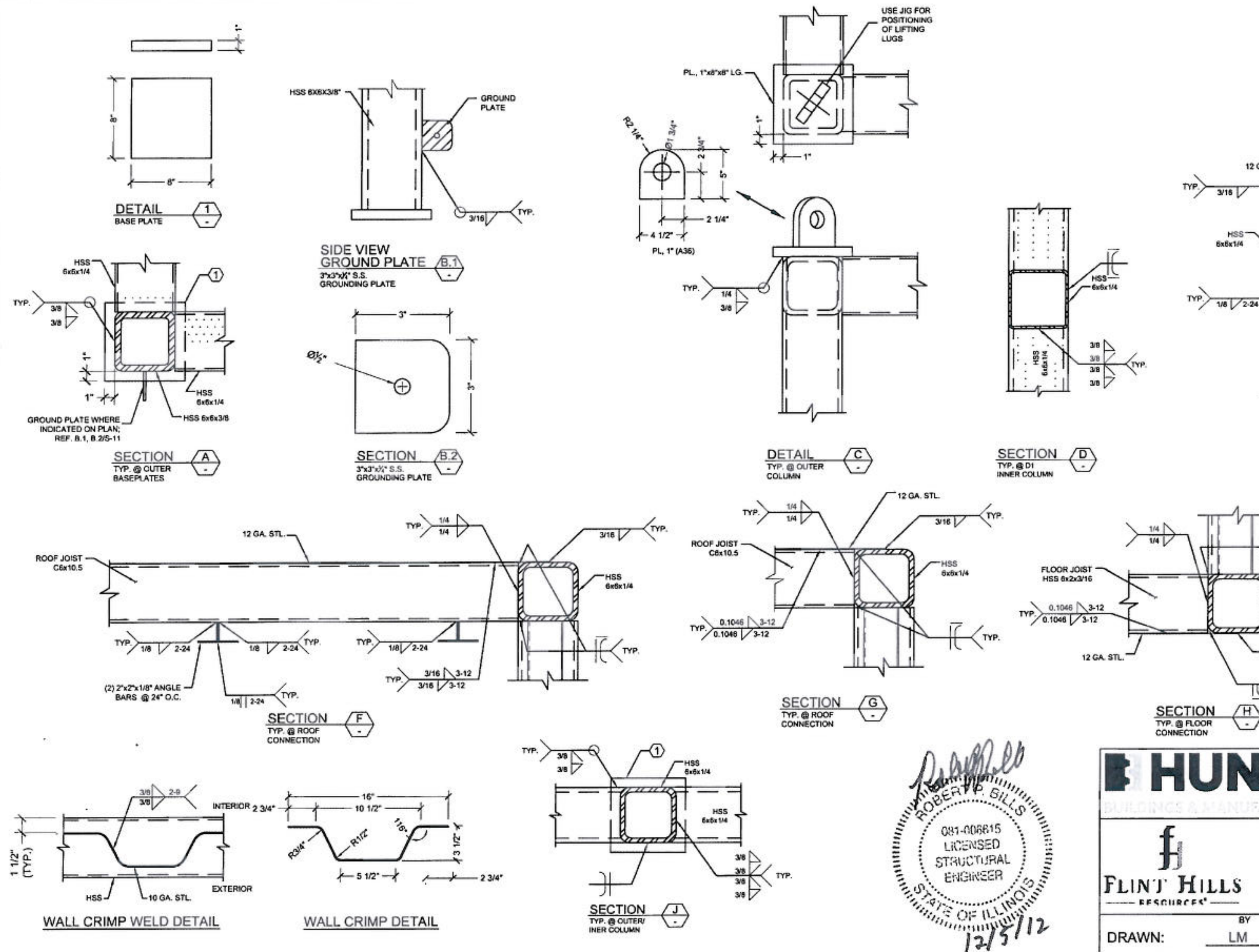
FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL FRAMING ELEVATIONS

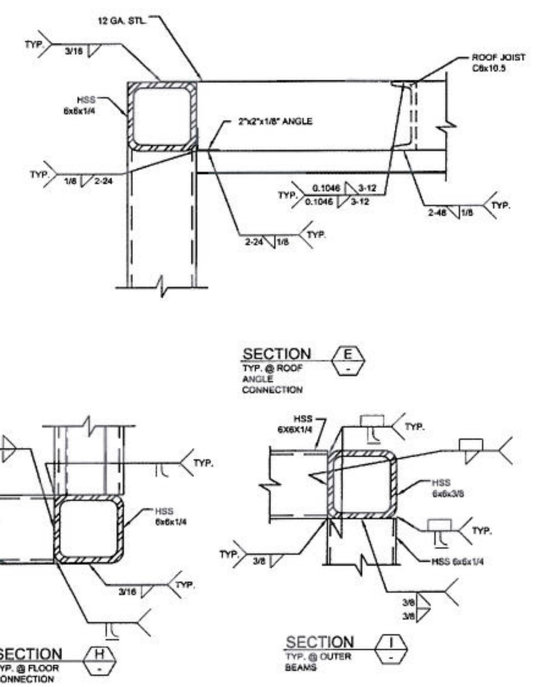
	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	3/16"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-08	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

FHRPRU001674

NOTES:
1. ALL WELDS MUST CONFORM TO LATEST AWS D1.1 SPECIFICATION
2. BUILDING SHALL BE PLACED ON A STABILIZED COMPACTED, LEVEL SURFACE. MIN. 98% STANDARD PROCTOR COMPACTION AND MINIMUM BEARING PRESSURE OF 2500 PSF.
3. FOUNDATION DESIGN IS THE RESPONSIBILITY OF THE CLIENT
4. SPACE BETWEEN BOTTOM TUBE AND GRADE SHALL BE CLOSED AFTER SETTING OF MODULE.





ROBERT P. BILLS
081-006615
LICENSED STRUCTURAL ENGINEER
STATE OF ILLINOIS
12/5/12

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

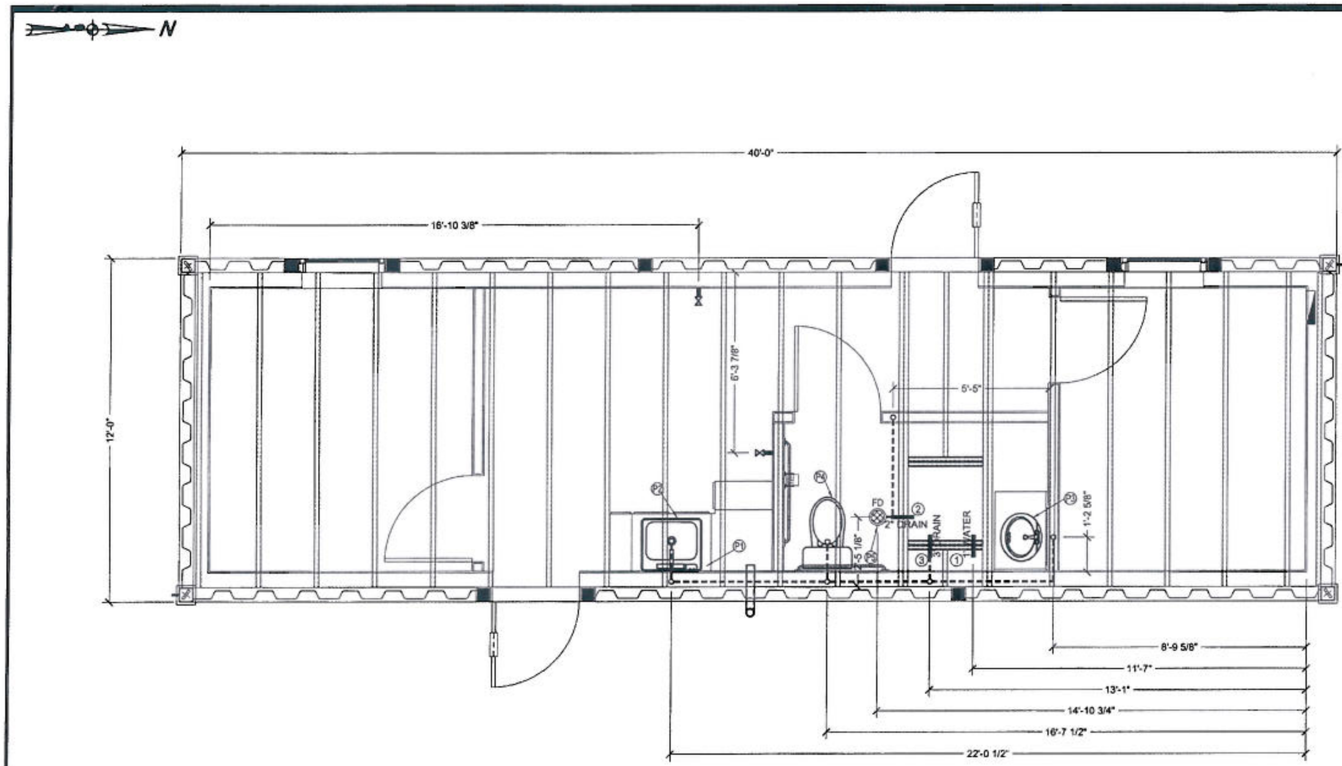
HUNTER
BUILDINGS & MANUFACTURING, LP

FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
STRUCTURAL WELDING DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S.
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			S-09	REV 0

FHRPRU001675



KEYNOTE:

(#) PLUMBING ISOMETRIC CALLOUT

1342 PLUMBING SCHEDULE				
ITEM	DESCRIPTION	MANUFACTURER	MODEL NO.	QTY.
P1	WATER HEATER	EEMAX	SP55DL	1
P2	SINK	ELKEAY	K23322	1
P3	LAVATORY	VORTENS	3521	1
P4	WATER CLOSET	KOHLER	K-3578	1
P5	FLOOR DRAIN	ZURN	Z450B	1

1342 PLUMBING COUPLING SCHEDULE			
NO.	DESCRIPTION	USE	SIZE
1	STAINLESS STEEL COUPLING (NPT)	WATER SUPPLY	Ø1"
2	STAINLESS STEEL COUPLING (NPT)	DRAIN LINE	Ø2"
3	STAINLESS STEEL COUPLING (NPT)	DRAIN LINE	Ø3"

NOTES:
1. ALL DIMENSIONS ARE FROM METAL STUDS.

OM P. NANGIA
062-031204
LICENSED PROFESSIONAL ENGINEER OF STATE OF ILLINOIS

DEC 05 2012

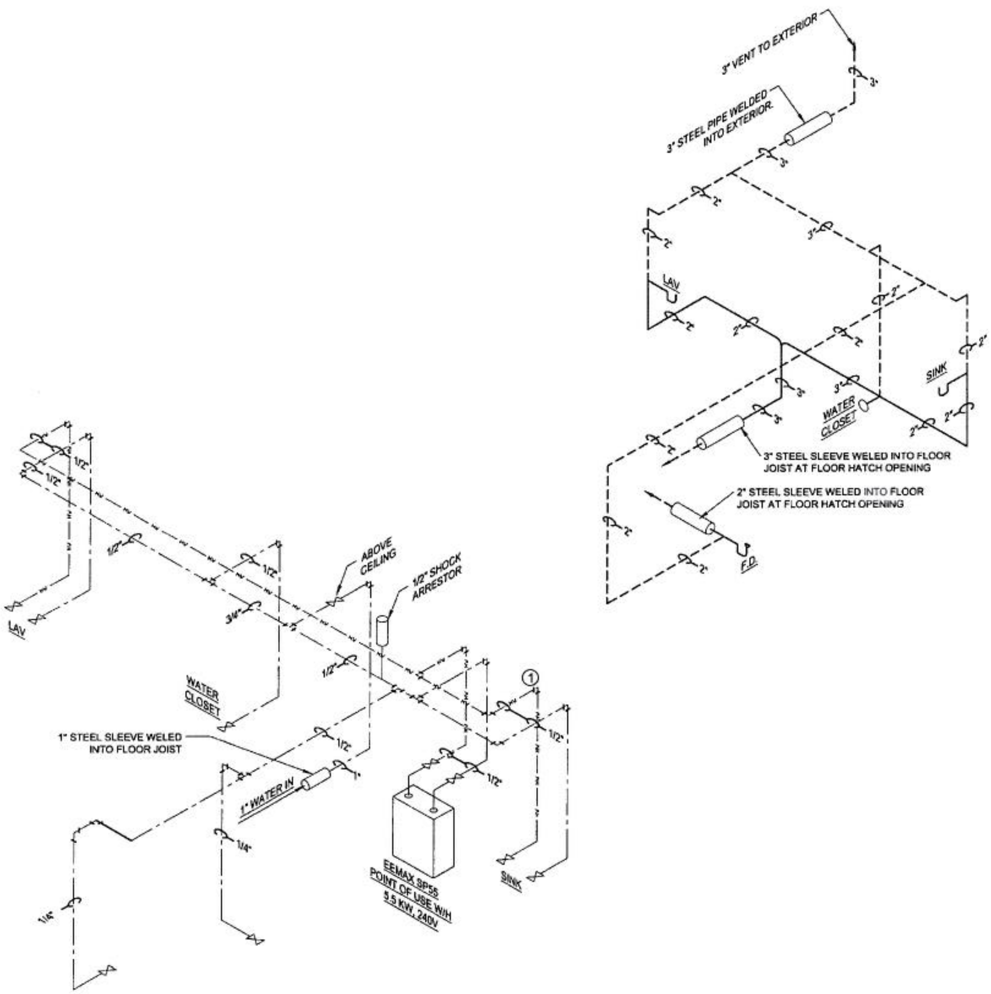
HUNTER
BUILDINGS & MANUFACTURING, LP

FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
PLUMBING LAYOUT DIMENSIONS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	1/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			P-01	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD



KEYNOTE:

(#) PLUMBING ISOMETRIC CALLOUT

LEGEND

SHUT OFF VALVE

COLD WATER

HOT WATER

OM P. NANGIA
062-031204
LICENSED PROFESSIONAL ENGINEER OF STATE OF ILLINOIS

DEC 0 5 2012

SHOCK ARRESTOR SCHEDULE	
Size	Fixture Unit Capacity
1/2"	1-11

MODULE WATER FIXTURE UNIT COUNT					
1341 CONTROL ROOM					
	FIXTURE TYPE	F.U. VALUE	QUANTITY	TOTAL F.U. FOR TYPE	TOTAL F.U. FOR
	WC - TANK	4.0	1	4.0	
	LAVATORY	1.0	3	3.0	
	SINK	2.0	1	2.0	
	MODULE TOTAL				9

1342 PLUMBING COUPLING SCHEDULE			
NO.	DESCRIPTION	USE	SIZE
1	STAINLESS STEEL COUPLING (NPT)	WATER SUPPLY	Ø1"
2	STAINLESS STEEL COUPLING (NPT)	DRAIN LINE	Ø2"
3	STAINLESS STEEL COUPLING (NPT)	DRAIN LINE	Ø3"

HUNTER
BUILDINGS & MANUFACTURING, L.P.

FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
PLUMBING RISER DIAGRAMS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			P-02	REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

PANEL SCHEMATIC
Service:120 / 208 Volt, 3Ø , 60 Hertz
Panel: Square D QO327MQ100

Wire	#	Circuit Description	Breaker	Breaker	Circuit Description	#	Wire
#3 THHN	1	Main Breaker	100A-2P	30A-2P	Emax SP55DL	2	#10 THHN
↓	3	↓	↓	↓	↓	4	↓
↓	5	↓	↓	20A-1P	Receptacles (3)	6	#12MC
#12MC	7	Receptacles (4)	20A-1P	20A-1P	Refrigerator	8	#12MC
#12MC	9	GFCI Receptacles (3)	20A-1P	20A-1P	Receptacles (4)	10	#12MC
#12MC	11	Exterior GFCI Receptacles (1)	20A-1P	20A-1P	Receptacles (4)	12	#12MC
#12MC	13	Receptacles (4)	20A-1P	20A-1P	Lighting (7)(1)/ Emer. Ltg. (2)/Fans (2)	14	#12MC
#12MC	15	Exterior Light (2)	20A-1P	20A-1P	Spare	16	
	17	Space			Space	18	
	19	Space			Space	20	
	21	Space			Space	22	
	23	Space			Space	24	
	25	Space			Space	26	
	27	Space			Space	28	
	29	Space			Space	30	

Load Analysis

Ckt. I.D.	Amp	Circuit Description	Connected Load	Calculated Load	Factor	Circuit Load
1/3/5	100A	Main Breaker				
2/4	30A	Emax SP55DL	10,512w	10,512.0	1.0	10,512.0
6	20A	Receptacles (3)	3x180w	540.0	1.0	540.0
8	20A	Refrigerator	1440w	1,440.0	1.25	1,800.0
9	20A	GFCI Receptacles (3)	3x180w	540.0	1.25	675.0
10	30A	Receptacles (4)	4x180w	720.0	1.0	720.0
11	20A	Exterior GFCI Receptacles (1)	1x180w	180.0	1.0	180.0
12	20A	Receptacles (4)	4x180w	720.0	1.0	720.0
13	20A	Receptacles (4)	4x180w	720.0	1.0	720.0
14	20A	Lighting (7)(1)/Emer. Ltg. (2)	7x64w+1x34w+2x8.4w+2x48w	498.8	1.25	****
15	20A	Exterior Light (2)	2x150w	300.0	1.0	****
NEC Tbl 220.12		Lighting 3.5 W / ft2	3.5va x 480 sf	1,680.0	1.25	2,100.0
					Total	17,967.0

LOAD = 17,967.00 VA / 208 Volts / 1.73= 49.9 Amps

LEGEND:

- FLUORESCENT 2X4 LAY IN 2 TUBE
- FLUORESCENT 2X2 LAY IN 2 TUBE
- EXIT — EXIT/EMERGENCY LIGHT WITH BATTERY BACK-UP
- EXTERIOR COMMUNICATIONS JUNCTION BOX NEMA 4
- EXTERIOR LIGHT,150W LED
- DUPLEX RECEPTACLE, 120V, 20 AMP
- GFCI WP — GFCI WEATHER PROOF RECEPTACLE, 20 AMP
- GFCI PROT. — GFCI DUPLEX RECEPTACLE 120V, 20 AMP
- 30 T/L — 30 AMP TWIST/LOCK RECEPTACLE
- $ — SWITCH SINGLE POLE, 120V, 20 AMP
- $3W — THREE WAY SWITCH, 120V, 20 AMP
- VOICE/ DATA DUPLEX JACK, 1 VOICE/ 1 DATA RJ45-568 A/B
- LOAD CENTER
- T — THERMOSTAT
- EXHAUST FAN
- VENT WITH BIRD SCREEN
- PLUMBING VENT PIPE
- PHOTO CELL
- JB — J-BOX FOR CLIENT PROVIDED AND INSTALL FIRE PROTECTTION EQUIPMENT

OM P. NANGIA
062-031204
LICENSED
PROFESSIONAL
ENGINEER
OF
STATE OF ILLINOIS

DEC 0 5 2012

NOTES:
1. ALL THHN WIRE TO BE RUN IN 3/4" EMT MINIMUM. MAXIMUM OF 4-20 AMP CIRCUITS INSTALLED IN EACH EMT CONDUIT. ALL OTHER CIRCUIT SIZES TO BE RUN SEPARATELY.

HUNTER
BUILDINGS & MANUFACTURING, L.P.

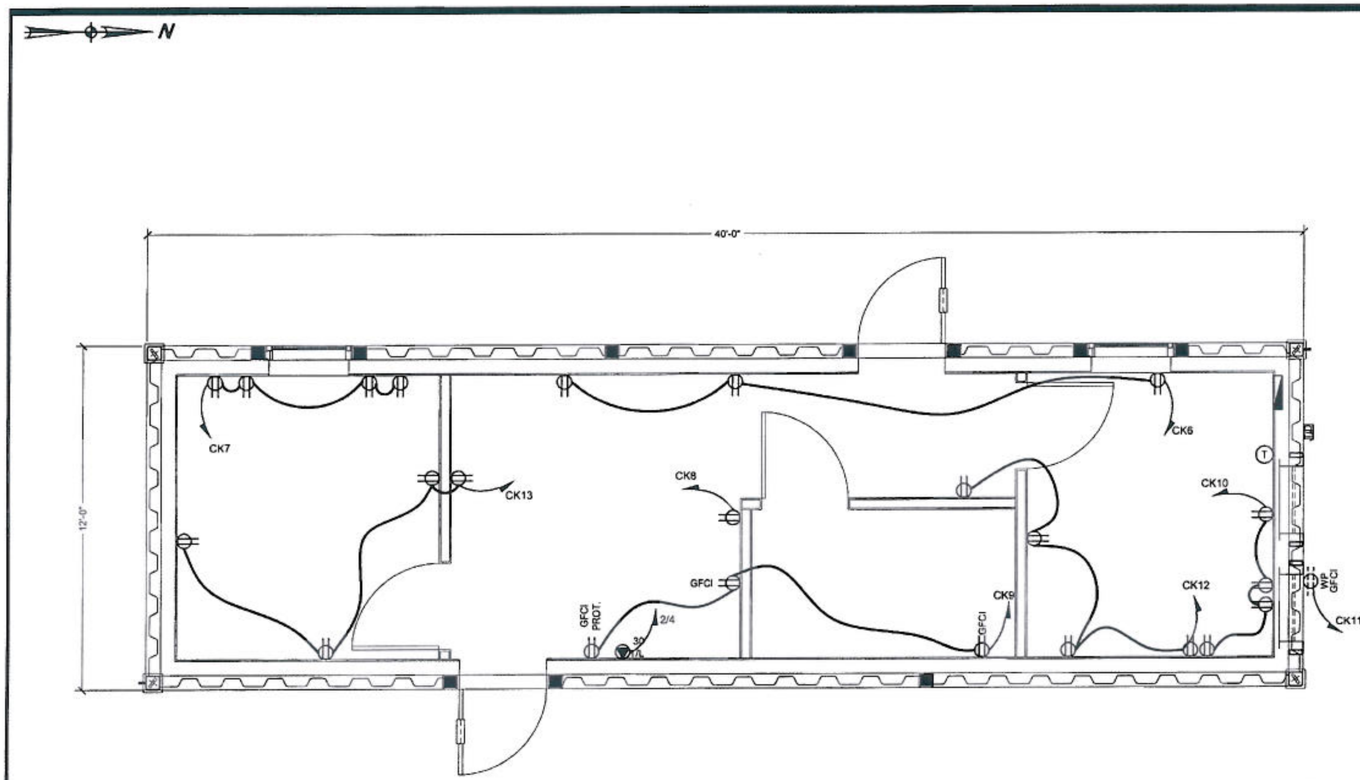
FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
ELECTRICAL PANEL SCHEMATIC / LOAD ANALYSIS / LEGEND

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S.
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:				E-01

REV 0

NO.	DATE	DESCRIPTION	BY	CHKD.	NO.	DATE	DESCRIPTION	BY	CHKD.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD



OM P. NANGIA
062-031204
LICENSED
PROFESSIONAL
ENGINEER
OF
STATE OF ILLINOIS

DEC 0 5 2012

LEGEND:

------ SWITCH LEG

——— POWER LEG

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
ELECTRICAL POWER PLAN

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	1/4"=1'-0"
CHECKED:	JD	8/07/12	JOB. No.	1342
ENGINEER:				
APPROVED:			E-02	REV 0

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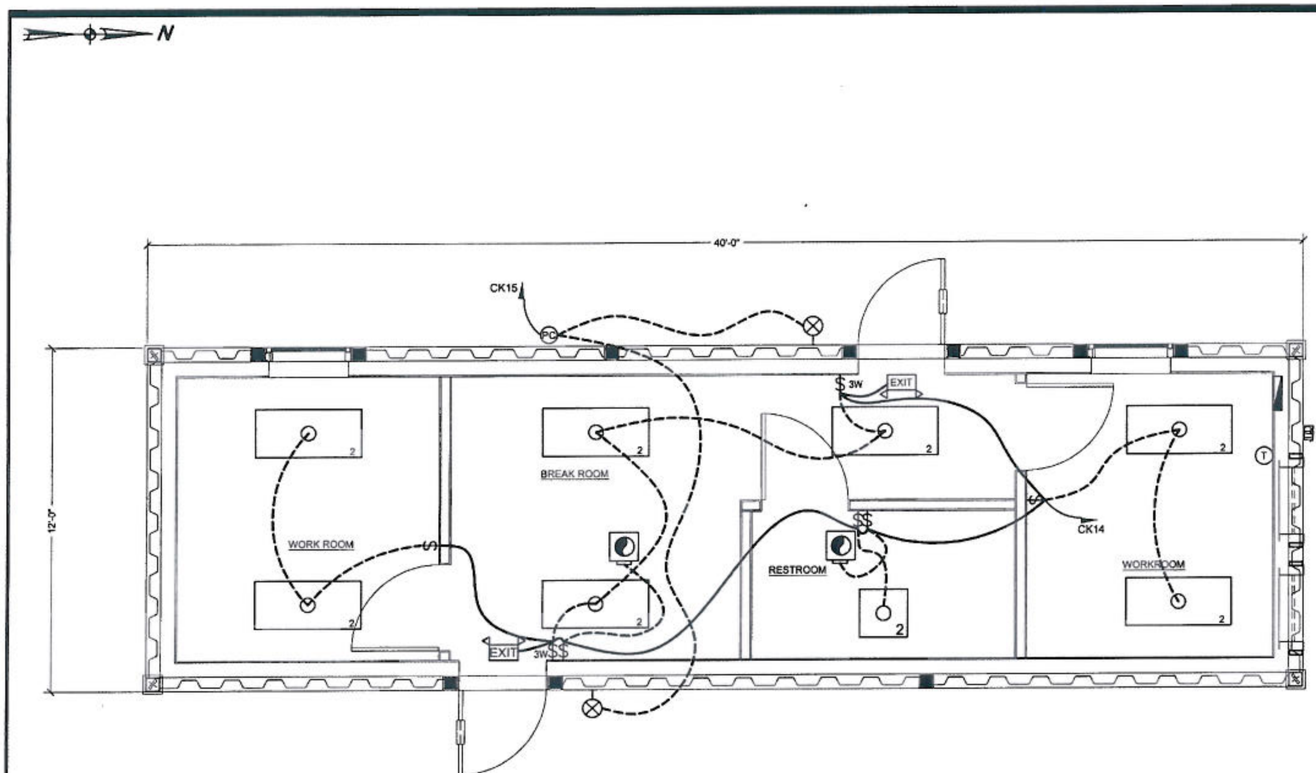

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PROFESSIONAL
ENGINEER
OF
STATE OF ILLINOIS

DEC 05 2012

LEGEND:

- - - - SWITCH LEG
—— POWER LEG

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
ELECTRICAL LIGHTING PLAN

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APPROVED:			E-03	REV 0

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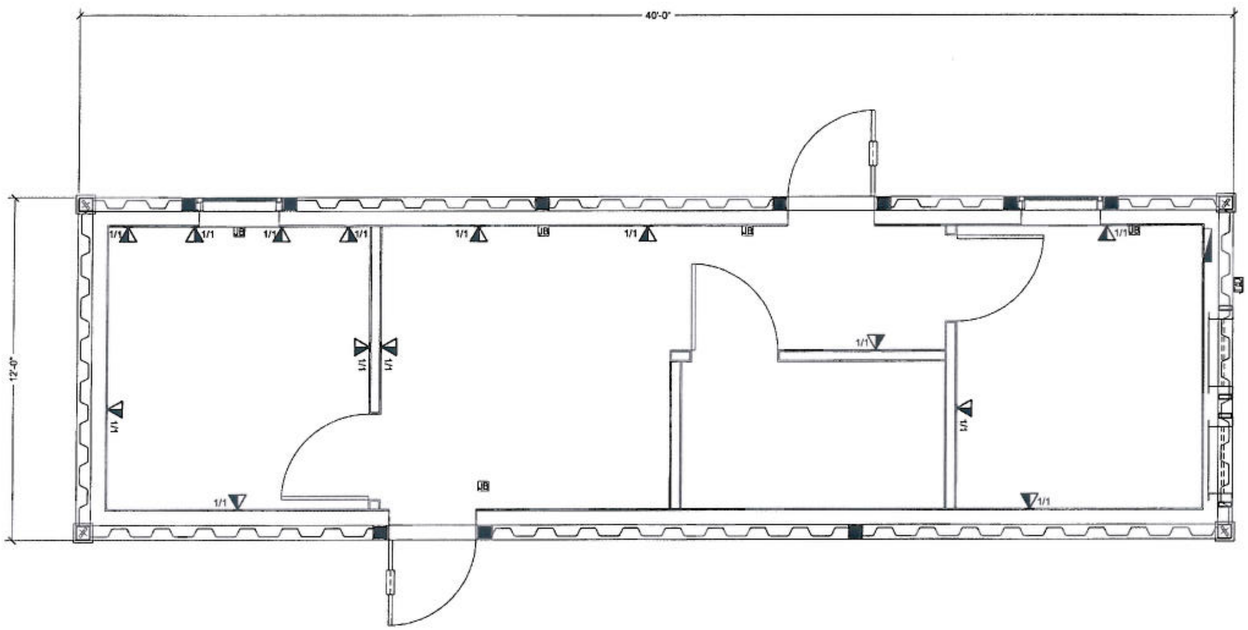

LEGEND

- VOICE/ DATA DUPLEX JACK, 1 VOICE/ 1 DATA RJ45-568 A/B
- EXTERIOR COMMUNICATIONS JUNCTION BOX NEMA 4
- J-BOX FOR CLIENT PROVIDED AND INSTALL FIRE PROTECTTION EQUIPMENT

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
COMMUNICATIONS LAYOUT

	BY	DATE		
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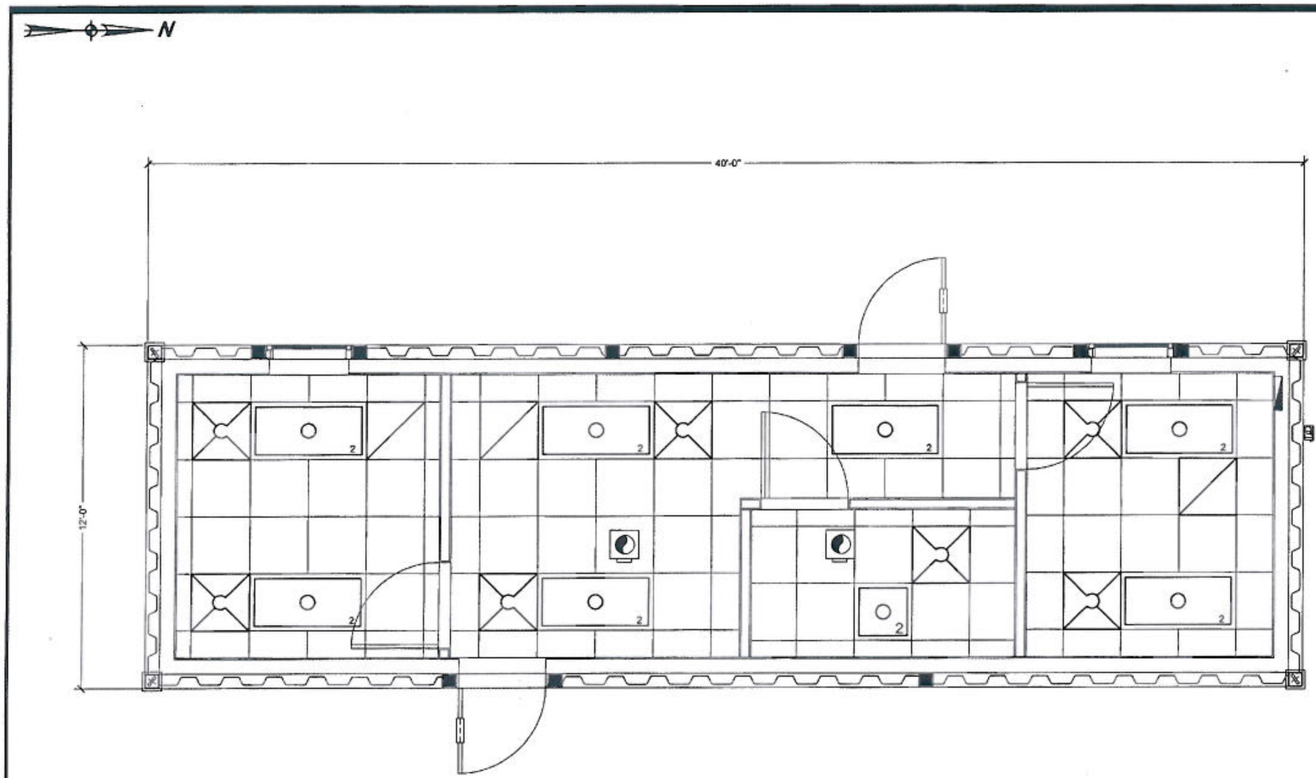

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
PILOT PLANT CONTROL ROOM
REFLECTED CEILING PLAN

	BY	DATE		
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APPROVED:			E-05	REV 0

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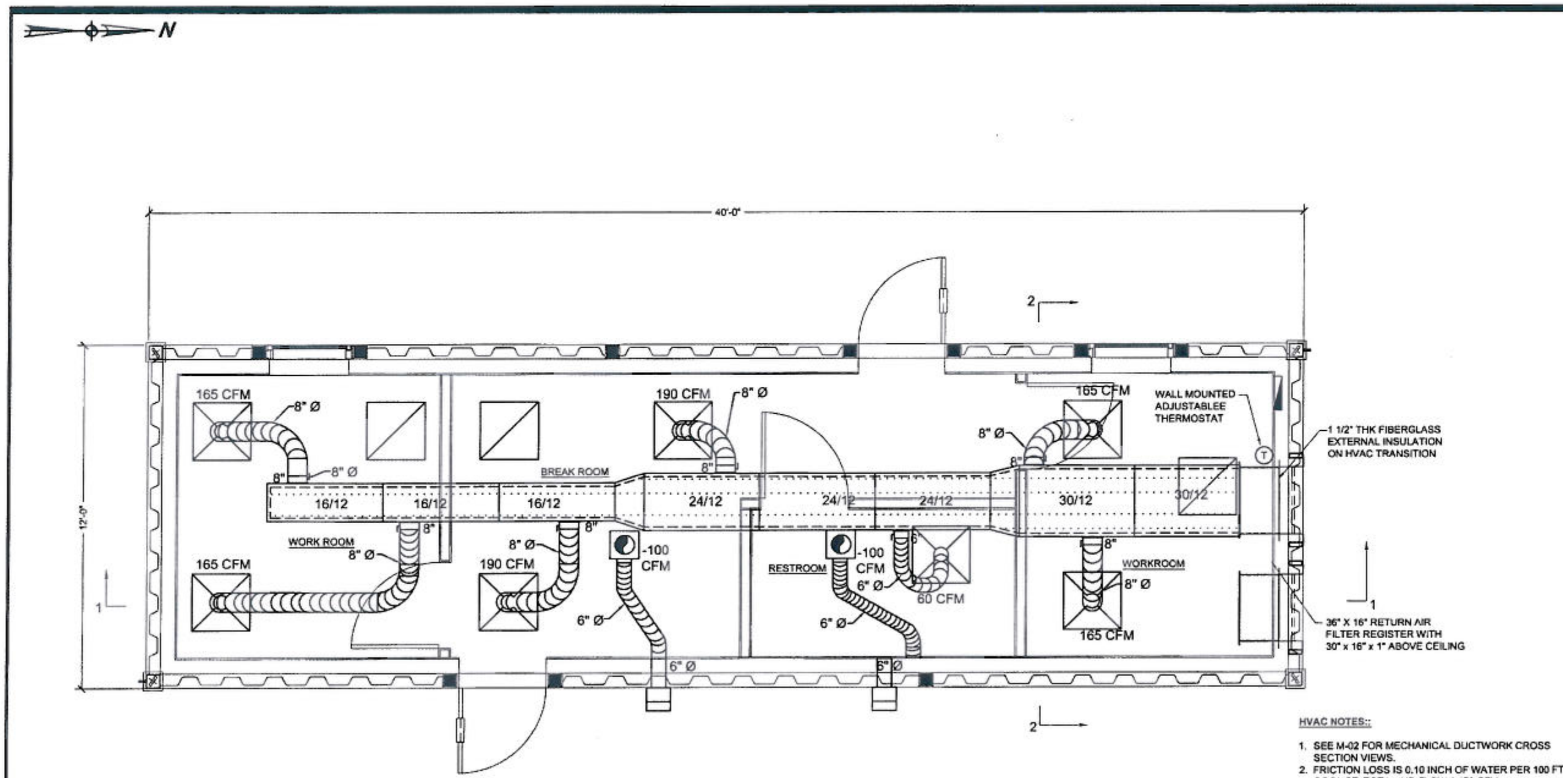

LEGEND:

	RETURN REGISTER
	SUPPLY REGISTER
	WALL MOUNTED EXHAUST HOOD
-80 CFM	CEILING EXHAUST FAN
8" Ø	SPIN-IN WITH RIGID ROUND DUCT (SUPPLY AIR REGISTER TAKE-OFF)
8"	FLEXIBLE ROUND DUCT
8"	SUPPLY AIR DUCT SPIN-IN
T	THERMOSTAT

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HVAC NOTES::

1. SEE M-02 FOR MECHANICAL DUCTWORK CROSS SECTION VIEWS.
2. FRICTION LOSS IS 0.10 INCH OF WATER PER 100 FT. OF DUCT. TOTAL AIR FLOW 1,150 CFM
3. SEE M-03 FOR DUCT WORK DETAILS.
4. SEE M-04 FOR DUCT AND DIFFUSER INSTALLATION DETAILS.
5. SEE M-05 FOR AIR FLOW DIAGRAM AND EQUIPMENT SCHEDULES.
6. SEE S-04 FOR HVAC UNIT FRAME AND WALL PENETRATION DETAILS.

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES CONTROL ROOM MECHANICAL DUCTWORK AND REGISTER LAYOUT

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	1/4"=1'-0"
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ENGINEER:				
APPROVED:			M-01	REV 0

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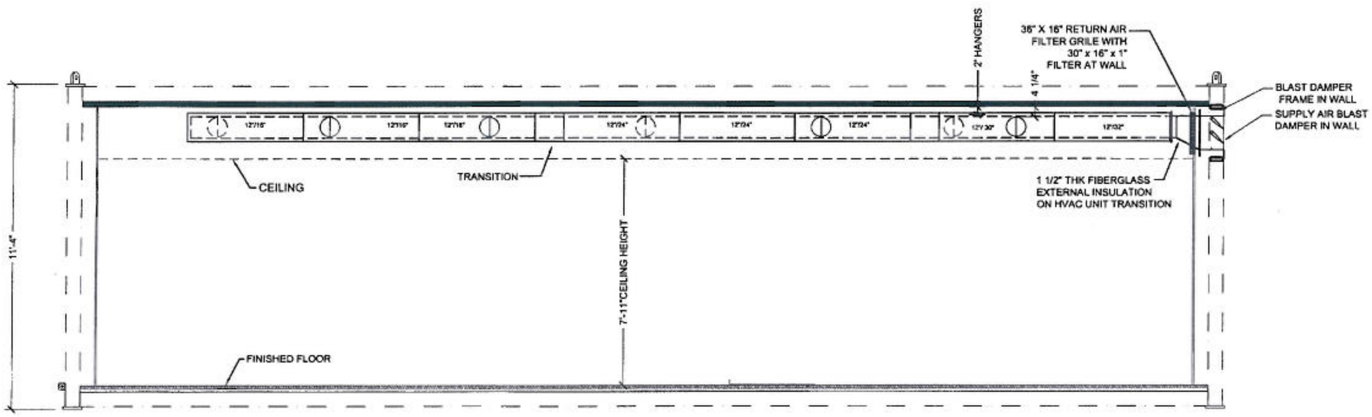
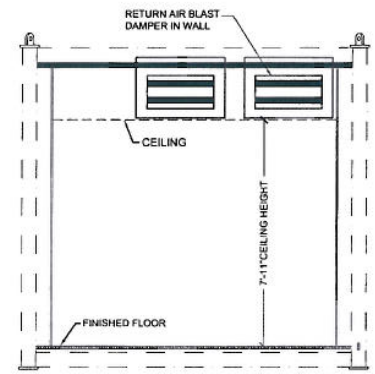


SECTION 1-1
REF. DRAWING M-01



SECTION 2-2
REF. DRAWING M-01

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HVAC NOTES:

1. SEE M-03 FOR SUPPLY AIR DUCT DETAILS.
2. SEE S-04 FOR HVAC UNIT FRAME AND WALL PENETRATION DETAILS.
3. SEE M-04 FOR MECHANICAL DUCTWORK INSTALLATION DETAILS.
4. SEE M-05 FOR AIR FLOW DIAGRAM, EQUIPMENT SCHOULES.
5. ALL INTERIOR SUPPLY DUCTWORK SHALL BE FABRICATED FROM 24 GA GALVANIZED SHEET METAL AND SHALL HAVE 1 1/2" THICK, R-6, FIBERGLAS INSULATION INTERNAL LINER.

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
CONTROL ROOM
MECHANICAL DUCTWORK
CROSS SECTIONS

	BY	DATE		
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APPROVED:			M-02	REV 0

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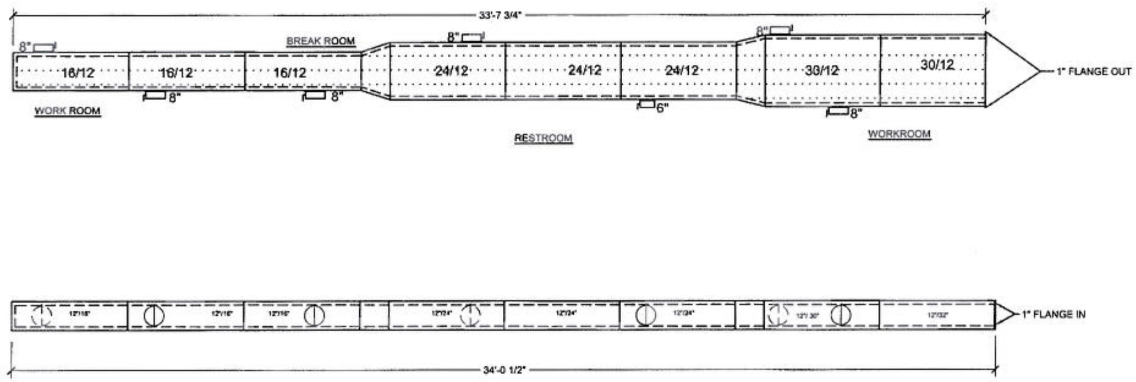

SECTION 1-1
REF. DRAWING M-01

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SHEET METAL DUCTWORK GENERAL NOTES

1. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY DIRECTED OTHERWISE.
2. SHEET METAL DUCT SIZES ARE OUTSIDE DIMENSIONS. LISTED SHEET METAL DUCT SIZES ALLOW FOR 11/2" R 6.0 DUCT LINER.
3. LOW PRESSURE ROUND FLEXIBLE DUCT TO HAVE A MINIMUM INSULATION VALUE OF R 6.0. ALL INSULATION TO MEET NFPA 90; UL 181-CLASS 1.
4. SHEET METAL SPIN-IN FITTINGS FOR DIFFUSERS SHALL BE CONICAL TYPE. SPIN-IN FITTINGS TO DIFFUSERS SHALL INCLUDE AN INTEGRAL MANUAL VOLUME DAMPER.
5. AFTER SYSTEM START-UP, BALANCE AIR DEVICES WITHIN 10% OF SCHEDULED AIR FLOW VALUES. PROVIDE OPERATION AND MAINTENANCE MANUALS TO BUILDING OWNER FOR ALL HVAC EQUIPMENT.

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-	-	-	-	-	0	12/01/12	ISSUED FOR CONSTRUCTION	JB	JD

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
CONTROL ROOM
MECHANICAL DUCTWORK DETAILS

	BY	DATE		
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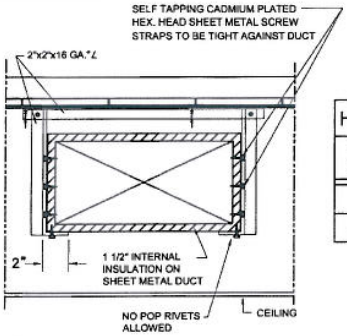
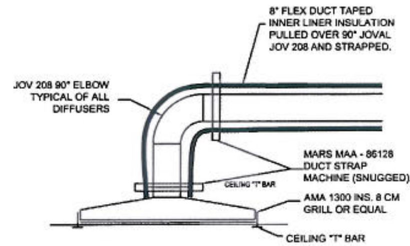
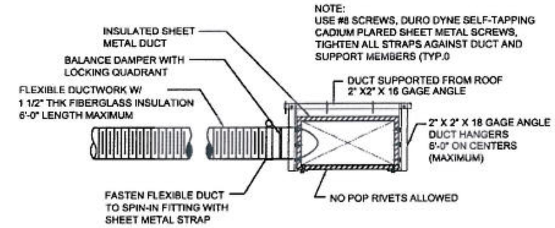


HANGER SIZES FOR RECTANGULAR DUCT			
MAX. SIDE	HANGER	HORIZONTAL SUPPORT ANGLE	MAXIMUM SPACING
30"	2" X 18 GAGE STRAP 2" X 2" X 18 GA. ANGLE	2" X 2" X 16 GAGE	6'-0"
36"	2" X 2" X 18 GA. ANGLE OR 1/4" ROUND ROD	2" X 2" X 16 GAGE	6'-0"

1/1 DUCT HANGER SUPPORT DETAIL
NO SCALE

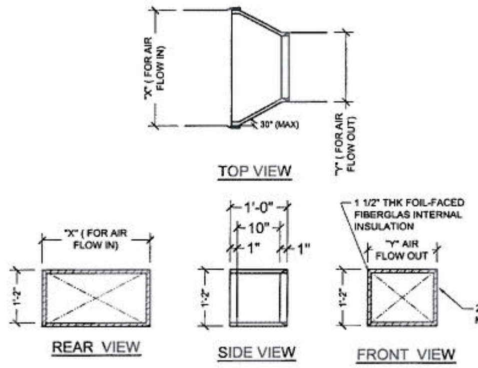


2/1 DIFFUSER DETAIL
NO SCALE



3/1 FLEX DUCT WITH SPIN IN FITTING DETAIL
NO SCALE

4/1 SLIP & DRIVE CONNECTION DETAIL
NO SCALE
REQUIRED FORALL INTERIOR SHEET METAL DUCTWORK



5/1 DUCT TRANSITION DETAIL
NO SCALE

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
CONTROL ROOM
MECHANICAL EQUIPMENT
SCHEDULE AND DUCT DETAILS

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S
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ENGINEER:				
APPROVED:			M-04	REV 0

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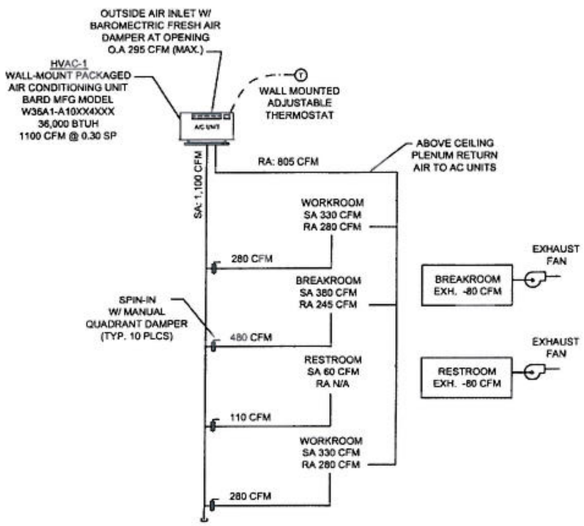

AIR FLOW SCHEMATIC

NOTE: RETURN AIR FLOW IS APPROXIMATELY 85 % OF DIFFERENCE BETWEEN THE SUPPLY AND EXHAUST AIR FLOW.

FAN SCHEDULE

MARK	MANUFACTURER & MODEL NO.	TYPE	LOCATION	CFM	STATIC PRESSURE IN.W.G.	MOTOR						ACCESORIES	REMARKS
						RPM	AMPS	HP	VOLTS	PH	HZ		
EF-1	BROAN MODEL 684	CEILING MOUNTED	RESTROOM	80	0.10	1280	0.50	1/10	115	1	60	CEILING EXH. GRILLE	CEILING MOUNTED EXHAUST GRILLE & 6" Ø FLEXIBLE ALUMINUM DUCT CONNECTED TO WALL HOOD
EF-2	BROAN MODEL 684	CEILING MOUNTED	BREAKROOM	80	0.10	1280	0.50	1/10	115	1	60	CEILING EXH. GRILLE	CEILING MOUNTED EXHAUST GRILLE & 6" Ø FLEXIBLE ALUMINUM DUCT CONNECTED TO WALL HOOD

1342 DUCT SCHEDULE

AREA SERVED	DUCT SIZE (in.)	CFM	DUCT QTY.	TTL. DUCT CFM
BREAKROOM	8"Ø	190	2	380
RESTROOM	6"Ø	60	1	60
WORKROOM	8"Ø	165	2	330
WORKROOM	8"Ø	165	2	330
			TOTAL CFM	1,100

1342 EXHAUST FAN SCHEDULE

AREA SERVED	DUCT SIZE (in.)	CFM	EXH. FAN QTY.	TTL. EXH FAN CFM
RESTROOM	6"Ø	80	1	80
BREAKROOM	6"Ø	80	1	80
			TOTAL CFM	160

ABBREVIATIONS

AMPS	AMPERES
BTUH	BRITISH THERMAL UNITS/HOUR
CFM	CUBIC FEET PER MINUTE
E.S.P	EXTERNAL STATIC PRESSURE
FLA	FULL LOAD AMPERES
HP	HORSE POWER
HVAC-1	HEATING VENTILATING & AIR CONDITIONING (UNIT #1
KW	KILOWATT
MCA	MAXIMUM CURRENT AMPERES
MOCP	MINIMUM OVER CURRENT PROTECTION
ODP	OPEN DRIP PROOF
RPM	REVOLUTIONS PER MINUTE
QTY	QUANTITY
T	THERMOSTAT
TTL	TOTAL
W.G	WATER GUAGE
Ø	DIAMETER

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FLINT HILLS RESOURCES

FLINT HILLS RESOURCES
CONTROL ROOM
AIR FLOW DIAGRAM, SCHEDULES

	BY	DATE		
DRAWN:	LM	8/07/12	SCALE:	N.T.S
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ORIGINAL

Facility Siting Study

Final Report (Rev 1)
July 2010

Prepared for:
Flint Hills Resources
Peru, IL

Prepared by:
Mike Moosemiller
Ernesto Gasulla
Ben Daudonnet

BakerRisk Project No.
01-02611-001-09

Peru Expandable Polystyrene Plant

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BakerRisk regards the work that it has done as being advisory in nature. The responsibility for use and implementation of the conclusions and recommendations contained herein rests entirely with the client.

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Appendices

1.0 INTRODUCTION

The Flint Hills Resources (FHR) Peru site is located in the city of Peru, Illinois along the Illinois River. The site produces expandable polystyrene using styrene and pentanes as the primary ingredients. Styrene is both flammable and somewhat toxic, and the pentanes are flammable. Other potentially hazardous chemicals include peroxide catalysts and a small propane tank.

The goals of the current work are to:

1. Model explosion scenarios using the latest modeling capabilities in the SafeSite$_{3G}$® software program.
2. Consider the impact of explosions on all buildings to be potentially occupied.
3. Develop a site-wide composite overpressure contour map that can be used to help make decisions about future locations of permanent and temporary buildings and process improvements.
4. Provide an overview of fire hazards resulting from dispersion of flammables.
5. Perform dispersion modeling of styrene releases to determine the distances to both toxic and odor threshold levels.

This report includes the study objectives and scope of work in Section 2, a plant description in Section 3 and study methodology in Section 4. Consequence and impact analysis results are described in Sections 5. Conclusions and recommendations are included at the end of this report in Section 6. More detailed results of this study are provided in the appendices.

2.0 Scope and Objectives

The key elements of this study are as follows:

1. Define representative release sources and locations to capture dominant consequence contributors for the facility.
2. Define zones of congestion and confinement for the site to support blast calculations.
3. Characterize buildings to be assessed for fire, explosion, and toxic impacts.
4. Analyze discharge and dispersion of materials for "credible worst case" (e.g. 2-inch hole sizes) for each release location, as well as for other credible events such as venting during runaway reactions, or peroxide explosions.
5. Calculate blast energy for each explosion source.
6. Estimate blast loads (reflected pressure and impulse values) for each surface of each building assessed.
7. Characterize BDLs and occupant vulnerability values for each building assessed in this study based on blast loads and building construction type using BakerRisk's proprietary BEAST code.
8. Calculate flammable and toxic gas concentrations for each building based on dispersion of release cases included in the model.
9. Prepare a report to document the analysis, summarize results, and provide recommendations for reducing excessive occupant vulnerability, if applicable.

This study focused on the potential for releases within the Peru process area. However, releases from the storage and dock areas were also considered.

3.0 Plant and Scenario Description

3.1 Building Evaluation

A list of the buildings evaluated in this study is provided in Table 1. The locations of these buildings are shown in Figure 1. According to FHR, none of the buildings assessed were specifically designed to be blast-resistant.

Table 1. Buildings Included in the Analysis

Building	Section	Description	Available Plans
Adjacent property 1		2 story over the corner, rest is 1 story, CMU walls, no other data available	None
Adjacent property 2		Warehouse across the tracks - no data available	None
Adjacent property 3		Multiple 5 story industrial buildings - concrete frame - no other data available	None
Adjacent property 4		Warehouse by the docks area	None
Adjacent property 5		Warehouse near the docks area	None
Administration Building	2 story administration	Steel framing - clay brick walls	Architectural
Administration Building	1 story warehouse	Steel framing - clay brick walls	Architectural
Bead Recovery Building		2 story building - steel framing - metal and transite siding.	None
Boiler Room		Steel framing, non load bearing CMU walls over the N side, other walls are corrugated siding.	Architectural
Building 1		2 story steel framing, lower level walls are CMU, higher level walls are corrugated siding, this building is locked down and scheduled for demolition.	Architectural
Catalyst Building		Load bearing CMU walls, open web steel joists with corrugated roof deck	Architectural
Chips	Polymerization	Industrial type heavy steel framing with steel and transite siding	Architectural
Chips	Pelletizing Area 1st Fl	Industrial type heavy steel framing with steel and transite siding	Architectural
Chips	Pelletizing area 2nd Fl	Industrial type heavy steel framing with steel and transite siding	Architectural
Contractor's trailer 1		Semitrailer between Bldg 8 and Administration Bldg	None
Diesel / Diesel Oil Buildings		Small steel siding sheds	None
East Fire Pump Building		Wooden frame with corrugated siding cladding.	None
East Guardhouse		Pac-Van modular cube	None
Electrical Building		Corrugated steel shack perched atop a platform.	None

FHRPRU001695

Building	Section	Description	Available Plans
EPS - Building 4	Main building	7 story moment and braced steel framing, CMU walls only at lower level, transite and corrigated steel deck all the rest. Intermediate floors: steel framing with concrete / steel deck.	Architectural
EPS - Building 4	Reactor Control Room	7 story moment and braced steel framing, CMU walls only at lower level, transite and corrigated steel deck all the rest. Intermediate floors: steel framing with concrete / steel deck.	Architectural
EPS - Building 4	Motor Control Room	7 story moment and braced steel framing, CMU walls only at lower level, transite and corrigated steel deck all the rest. Intermediate floors: steel framing with concrete / steel deck.	Architectural
EPS Warehouse	Packout High Bay	One story steel framing with metal siding warehouse with a high tower.	Architectural
EPS Warehouse	Main Ware-house	One story steel framing with metal siding warehouse with a high tower.	Architectural
Flare Building		Steel framing with mixed transite and CMU walls	Architectural
Locker Room Building		2 story steel framing building with corrugated metal siding and roof deck	None
Maintenance Building	2 story section (N)	Steel framing building, corrugated metal siding walls.	Architectural
Maintenance Building	1 story section	Steel framing building, corrugated metal siding walls.	Architectural
Maintenance Building	Contrac-tors Break-room	Steel framing building, corrugated metal siding walls.	Architectural
Packout Storage Building		Heavy steel framing with mix of transite and CMU walls.	Architectural
Pilot Plant		4 story Heavy all bolted steel frames - Transite wall panels - Diamond plate floors on steel floor framing.	Architectural
Poly Building 2		3 story transite panels - interior details unknown - this building is locked down and scheduled for demolition.	None
Poly Building 3		5 story transite panels - interior details unknown - this building is locked down and scheduled for demolition.	None
Propane Tank Fill House		Small CMU enclosure	Architectural
PS Warehouse		Metal framing building with metal siding	Architectural
QA Lab Building		1 story warehouse steel framing and siding	Architectural
Refrigeration House		Small metal framing with transite panel walls and roof and wooden purlins.	None
South Extrusion Building	Main body (1st floor)	Multistory steel framing and steel siding warehouse	Architectural
South Extrusion Building	2nd floor	Multistory steel framing and steel siding warehouse	Architectural
South Extrusion Building	3rd floor	Multistory steel framing and steel siding warehouse	Architectural
Storage3 Building 8		Load bearing CMU walls - all wooden roof and midspan columns - Small 2'x3' windows over N side	None

Building	Section	Description	Available Plans
TD Lab Building		High bay warehouse - load bearing CMU walls - open web steel joists - corrugated metal deck	None
Unloading Dock Building		Load bearing brick walls, steel trusses, ridged wooden roof deck and purlins. Small 1'-6" x 2'-6" windows, mostly infilled with brick.	None
Warehouse adjacent to TD Lab	Similar con-struc-tion to TD Lab	Warehouse adjacent to TD Lab	None
Waste Water Treatment Bldg.		Load bearing CMU - Open web steel joists roof	None
Water Treatment Building		High bay warehouse - Load bearing CMU - Open web steel joists roof	Architectural
West Fire Pump Bldg.		Steel framing with metal panels	None

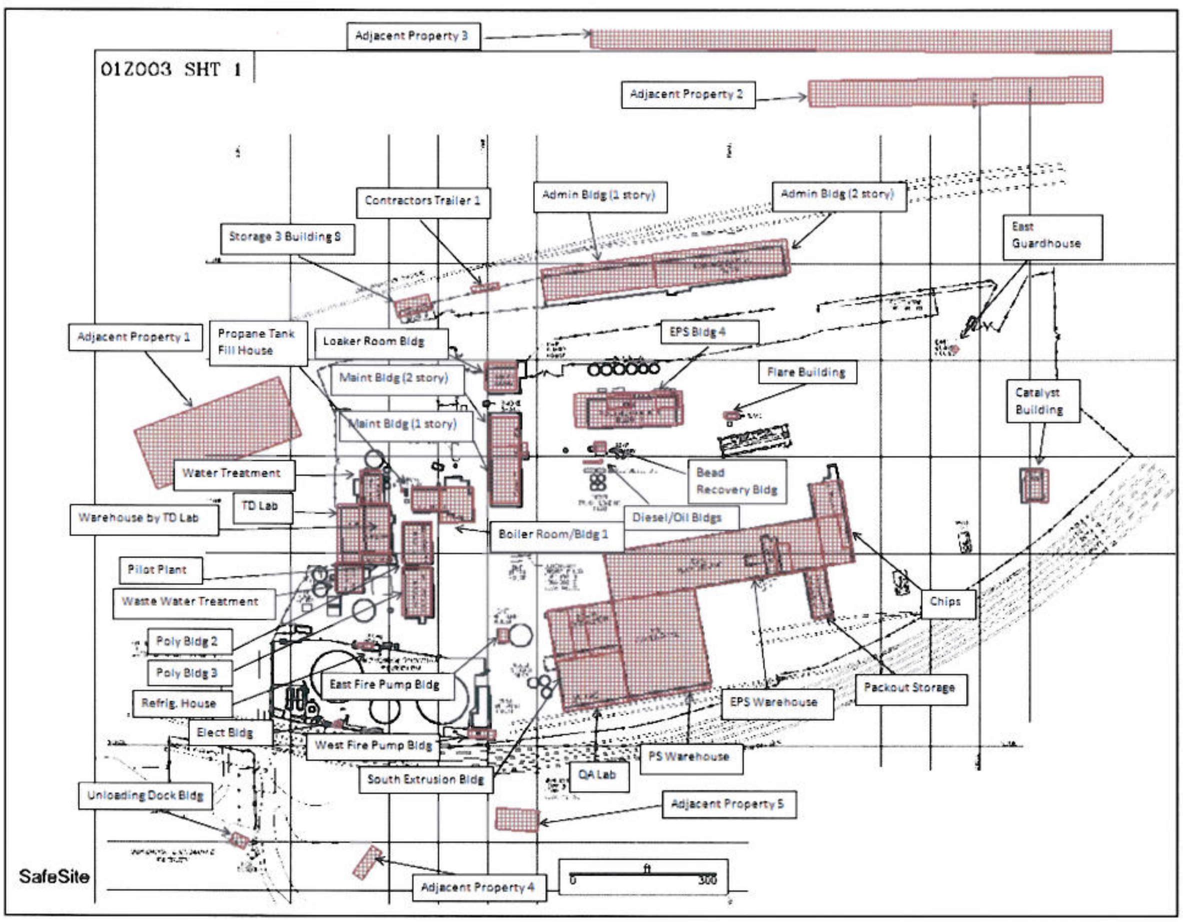

Figure 1. Peru Building Locations

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3.2 Zones of Congestion and Confinement

Appendix A describes the technology used in explosion strength prediction. Identifying the amount of congestion and confinement present in a facility is key to accurately predicting explosion strength since these areas promote vapor cloud agitation which, in turn, causes the flame acceleration that can result in damaging blast waves. Figure 2 shows an overview of the site with zones of congestion displayed as solid or hatched red or blue areas. As can be seen in the figure, most of the areas of congestion are located inside existing buildings.

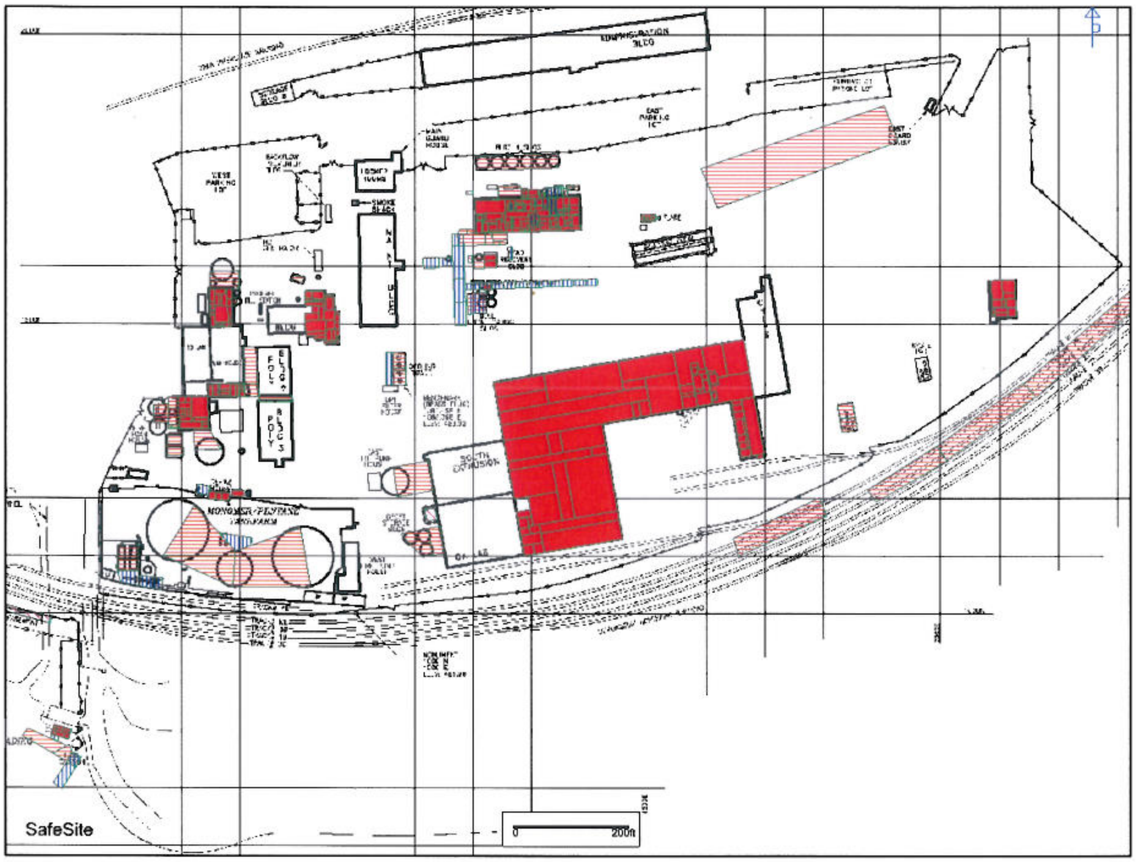

Figure 2. Zones of Congestion and Confinement at Peru Facility

FHRPRU001698

Figure 3 provides a 3-D view of these zones and buildings (in brown hatch). Buildings defined as zones of congestion appear in solid blue color.

Based on discussions with the site, some buildings are tight enough that they strongly inhibit the ingress of outdoor gas clouds. Other buildings have large openings, particularly during the summer. As a screening-level generalization, "tight" buildings are assumed to be impervious to external gas clouds and others are assumed to be completely open. The latter group includes the following buildings:

- Barge dock building
- TD warehouse
- Gecet storage silo
- Maintenance shop
- North building
- Packout building
- Poly building
- South extrusion building
- South building

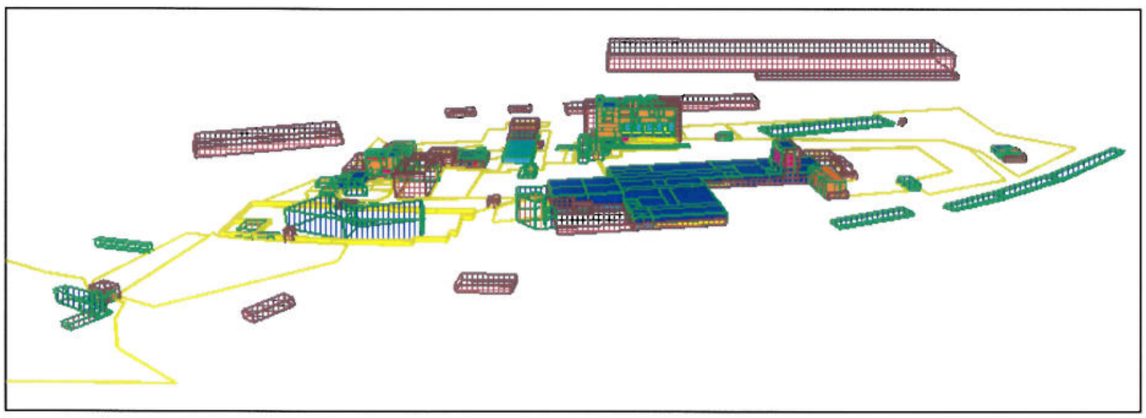

Figure 3. 3-D View of Buildings and Zones of Congestion and Confinement

3.3 Ground Surfaces

Preliminary modeling indicated that the surface onto which a spill falls can have a significant effect on its evaporation and dispersion, particularly in the case of styrene. The Peru site has a mixture of surface types, segregated as shown by the red lines in Figure 4.

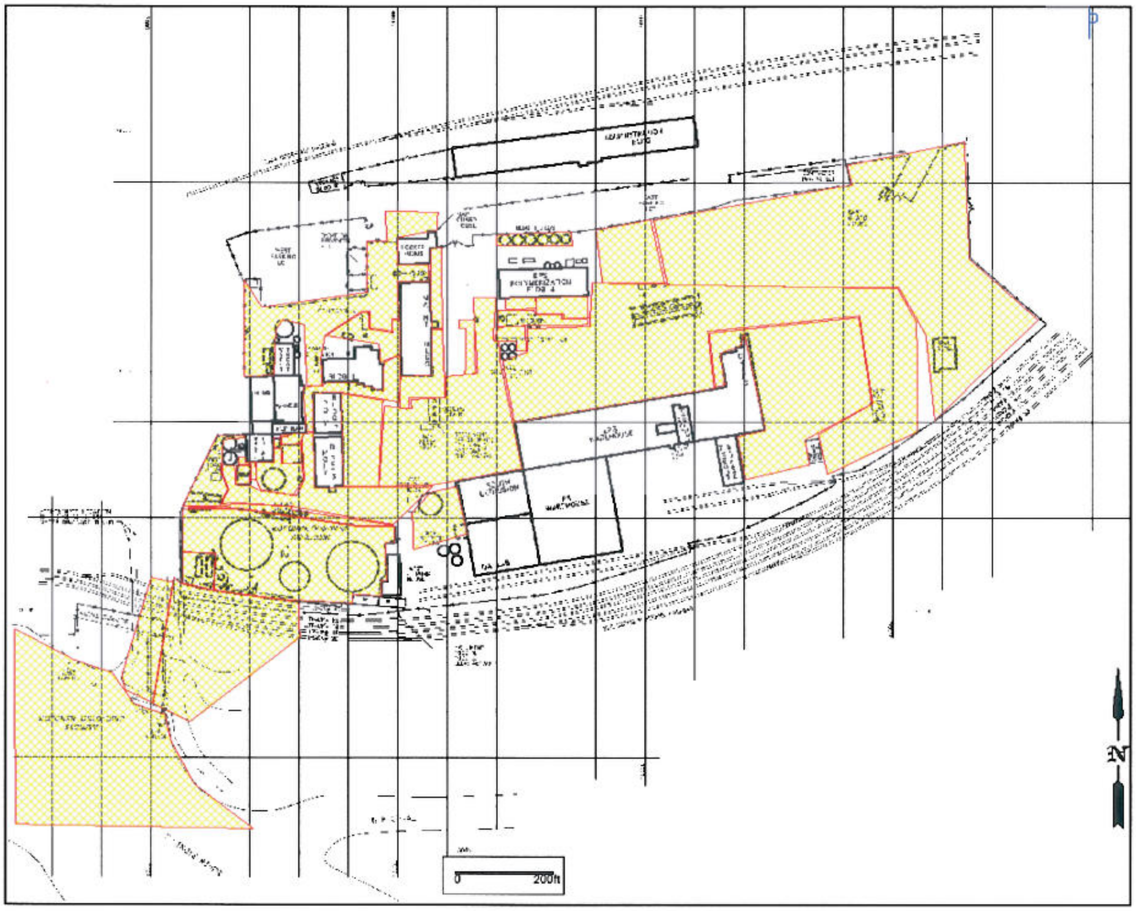

Figure 4. Spill Surface Areas

These surfaces are used to define the rate of thermal transfer between the ground and a liquid pool, the pool depth in the absence of containment such as a dike, and other variables that impact the degree to which a material may vaporize from the surface of a pool.

4.0 MODELING

4.1 Scenarios Selected

Credible scenarios were selected and evaluated for fire, toxic and explosion potential from all areas of the site. Scenarios were included even if they did not have the potential to impact an existing building so that a site-wide composite overpressure contour can be generated.

Most of the scenarios selected were based on utilizing a two-inch release size, the details of which were defined based upon the site walk-through and discussions with FHR personnel. The list of explosion scenarios included in this analysis, together with the process information utilized in the consequence modeling, is provided in Table 2.

The basis of modeling 2-inch hole sizes could be considered either conservative or non-conservative, however:

- 2″ holes are the most commonly-used, 'traditional' bases used in facility siting studies. On the basis of representing a "worst credible case" event, larger hole sizes are much less likely to occur;
- The use of larger hole sizes would not increase the severity of most of the events modeled in this study, since (a) most of the events are limited by the normal production flow available in the process, (b) depending on the direction of the release, the magnitude of an explosion is often limited by the limited dimensions of the zones of congestion/confinement encountered by the gas cloud.

For these reasons, 2-inch hole sizes represent a traditional industry "standard" for facility siting studies, and have been adopted by FHR for this purpose.

It should be noted that each of the scenarios modeled in this study has multiple layers of protective measures in place to prevent it from happening, such as rigorous design, ongoing inspections, building ventilation, etc. This analysis assumes that these measures have failed.

In addition to the events modeled in this study, there is the potential for a dust explosion in the Packout building if dust is allowed to accumulate. This issue is being reviewed separately from this current study.

Table 2. Release Case Conditions

Name	Description	Comp.	Temp. (F)	Pressure (psig)	Limits/Comments	Modeling Details
S-01-Barge2Water	Spill from styrene supply barge pump onto water	Styrene	85	35	Assume spill directly from barge pump discharge onto water. Limited by pump rate to 2300 gallons/min (17,200 lb/min)	For 2" hole, the actual release rate is less than the pump limit.
S-02-Unload	Unloading styrene from barge	Styrene	85	35	Spill onto ground between barge and styrene storage tank (outside walled area). Limited by pump rate to 2300 gallons/min (17,200 lb/min)	For 2" hole, the actual release rate is less than the pump limit.
S-03-Storage	Styrene release from storage tank	Styrene	85	Max. liquid head	Spill directly from styrene storage tank to walled area. Assume that the floor of the walled area of the tank farm could be fully wetted with styrene.	OK
S-04-TransferPP	Release from transfer line between styrene storage and pilot plant.	Styrene	72	50	Spill into non-walled area. Assume the rate at which material could be released is limited by a maximum pump rate of 80 lb/min to the pilot plant.	Pressure and hole size lowered to get 80 lb/min rate.
S-05-TransferB4	Release from transfer line between styrene storage and Building 4.	Styrene	72	60 @ pump 15 @ building	Spill into non-walled area. Assume the rate at which material could be released is limited by a maximum pump rate of 3750 lb/min to Building 4.	Pressure lowered to get 3750 lb/min
S-06-PilotPlant	Release of styrene within the Pilot Plant.	Styrene	72	n/a	Assumes that a portion of the pilot plant can be filled to stoichiometric concentration of styrene. Primarily 2nd floor, could leak to 1st also.	Filled second floor zones to a height of 4 feet of flammable range material. Pool evaporation rate of ~ 20 lb/min. See discussion and footnote for event P-05 regarding the impact of ventilation; the same principle is applied.

Name	Description	Comp.	Temp. (F)	Pressure (psig)	Limits/Comments	Modeling Details
S-07-Bldg4	Release of styrene within Building 4.	Styrene	72	n/a	Assumes that a portion of Building 4 can be filled to stoichiometric concentration of styrene. Release on 6th floor, but lots of openings to leak to floors below.	Filled 6th floor zones to a height of 4 feet. Diked evaporation rate very close to vapor rate needed to generate 1/2LFL steady-state concentration. P-06 is worse.
P-01-Truck/Rail	Release from pentane supply truck/railcar onto ground	Pentane[1]	82		Assume spill directly from truck/railcar pump discharge onto ground outside walled area. Limited by pump rate to 1600 lb/min, and a total inventory of 156,532 lbs per car.	Verify 1600 lb/min
P-02-Storage	Pentane release from storage tank	Pentane	82	Max. liquid head	Spill directly from pentane storage tank to walled area. Assume that the floor of the walled area of the tank farm could be fully wetted with pentane.	Consider for both vapor dispersion and for potential BLEVE[2] of tank.
P-03-TransferPP	Release from transfer line between pentane storage and pilot plant.	Pentane	82	100	Spill into non-walled area. Assume the rate at which material could be released is limited by a maximum pump rate of 5 lb/min to pilot plant Reactor 4.	Used small line size, and greatly lowered pressure, to get 5 lb/min. Almost certainly a trivial case.
P-04-TransferB4	Release from transfer line between pentane storage and Building 4.	Pentane	82	160	Spill into non-walled area. Assume the rate at which material could be released is limited by a maximum pump rate of 525 lb/min, based on normal transfer rate of 230 lb/min.	Lowered pressure to get 525 lb/min.
P-05-PilotPlant	Release of pentane within the pilot plant.	Pentane	82	n/a	Assumes that a portion of the Pilot Plant can be filled to stoichiometric concentration of pentane. Primarily 3rd floor. Also note that most of the 3rd floor is open to the 2nd floor.	Filled all zones on 3rd floor and half of zones on 2nd floor.[3]

[1] All streams referred to as "pentane" are assumed to be a mixture of 85% n-pentane and 15% isopentane.
[2] BLEVE = Boiling Liquid Expanding Vapor Explosion. Would occur only if fire impinged on a tank for an extended period of time.
[3] It is expected that an interior release of pentane could only occur at the maximum fill rate of 5 lb/min. Under normal ventilation it is expected that flammable range concentrations would not develop. However, for the purposes of this analysis it is assumed that the same event that caused the release also results in loss of power/ventilation. At a conservative (low) natural ventilation rate of 1 air change/hour, and perfect mixing in the room, the concentration in the room is calculated to reach ½ LFL in about 5 minutes. At ½ LFL average concentration, it is assumed that there will be pockets of >LFL concentration.

Name	Description	Comp.	Temp. (F)	Pressure (psig)	Limits/Comments	Modeling Details
P-06-Bldg4	Release of pentane within Building 4.	Pentane	82	n/a	Assumes that a portion of Building 4 can be filled to stoichiometric concentration of pentane. Release on 6th floor, but lots of openings to leak to floors below.	Filled 6th floor, assumed each floor below had half as many zones as the one above, down to 3rd floor. Maximum pump rate of 525 lb/min, and full level pool evaporation rate of ~ 300 lb/min, exceed 200 lb/min rate necessary to generate LFL concentration at steady-state.
PR-01-Hose	Release of propane from 1" hose rupture	Propane	70	Vapor pressure	Assumes 1"hose failure case is much more likely than 2" hole in the tank itself. Release limited to 4881 lb inventory in tank.	OK
R-01-LPReliefPP-set	Low pressure relief from pilot plant at set pressure conditions	Styrene/ Polystyrene	124 (C)	1	Assume conditions used for R02 from Fauske report. Release through 2" line downward into 14.7' × 5.1' rectangular pit.	Reset temperature to 146C to match vapor fraction from Fauske (Huntsman) report. 600 lb. Inventory, release rate of 293 lb/min, assumed to be all styrene.
R-01-LPReliefPP-peak	Low pressure relief from pilot plant at peak pressure conditions	Styrene/ Polystyrene	175 (C)	21	Assume conditions used for R02 from Fauske report.	Reset temperature to 183C to match 21 psig vapor pressure.
R-02-HPReliefPP-set	High pressure relief from pilot plant	Pentane	145 (C)	195	Assume conditions used for pentane portion from R02 from Fauske report, limited to 50 pounds total discharge.	Treated as horizontal discharge with all of release pointed in same direction.
R-02-HPReliefPP-peak	High pressure relief from pilot plant	Pentane	185 (C)	390	Assume conditions used for pentane portion from R02 from Fauske report, limited to 50 pounds total discharge.	Treated as saturated liquid release at 185C. Treated as horizontal discharge with all of release pointed in same direction.
R-03-LPReliefB4dump	Low pressure relief from Building 4	Styrene/ Polystyrene			*See "Special Note Regarding Scenario R-03" in Appendix E*	*Used "pumped + pipe" option to get desired flash fraction.*

Name	Description	Comp.	Temp. (F)	Pressure (psig)	Limits/Comments	Modeling Details
R-04-HPReliefB4	High pressure relief from Building 4	Pentane			Assume conditions used for pentane portion from Fauske report, limited to 4000 pounds total discharge.	Release from 8" pipe at 20.04 lb/sec.
R-05-LPReliefB4top	Low pressure relief from Building 4 – Protection fails	Styrene/ Polystyrene			Similar to R-03-LPReliefB4. Assume bottom valve fails to open, but vent relief (rupture disk) still works properly.	Assume that in this case the liquid portion of the release will spray out and cool. The maximum rate of discharge is at ~234C, 88 lb/s styrene liquid+vapor. Horizontal discharge?
PS	Explosion of 2 pallets of benzoyl peroxide	Benzoyl peroxide				Model 2,880 lbs of peroxide (wet basis) as 688 lbs TNT equivalent, based on approach below[4].
PSB4	Explosion of 2 pallets of benzoyl peroxide inside Bldg. 4	Benzoyl peroxide				Model 2,880 lbs of peroxide (wet basis) as 688 lbs TNT equivalent, based on approach below[5].

[4] TNT Equivalent = (Mass peroxide (dry)) x (Energy of decomposition of peroxide) / (Energy of detonation of TNT)
[5] TNT Equivalent = (Mass peroxide (dry)) x (Energy of decomposition of peroxide) / (Energy of detonation of TNT)

4.2 Consequence Analysis

Some of the modeling approaches used in this analysis are described here:

- **Define Environment:** Conservative weather conditions are used in this model to represent a calm summer night with low wind speed (wind speed 2 m/s, atmospheric stability F), although a more typical condition ("D5") was also modeled to ensure it was not worse. In addition, spill surface, evaporation, and spill containment areas are included in the model, where appropriate.

- **Model Release Cases:** BakerRisk's SafeSite$_{3G}$® computer code was used to model the release rates and subsequent dispersions. Process conditions were entered into the software. Except where prevented by the physical layout of the equipment, the releases were assumed to be oriented horizontally and aligned with the wind to yield the largest downwind plume. Vapor clouds were oriented in 16 directions to maximize consequences of any ensuing explosion.

- **Consequence Results:** One primary consequence of interest within this study concerns releases of flammable material that could explode, producing blast loads with the potential to injure personnel and damage buildings and equipment. This study uses SafeSite$_{3G}$® for the modeling of explosions. SafeSite$_{3G}$® uses the BST methodology[6,7], a leading edge explosion model, validated and tested with large-scale vapor cloud explosion field tests. The software was used to determine the intersection, in three dimensions, between the dispersed material and the volumes of congestion. The energy within these areas of congestion is then used in predicting the pressure and impulse from a VCE. Appendix A describes more information regarding vapor explosion prediction methodology.

- In the unlikely event that a release of flammable material occurs and subsequently explodes, this study evaluates blast loads on buildings themselves. Pressure plots are generated to provide the reader with a visual indication of the magnitude of energy resulting from each scenario. Building types are entered in the program, based on documentation supplied by Client and physical inspection of the buildings. By combining blast overpressure and impulse with the building construction type, BDLs and occupant vulnerabilities are calculated.

- Effects of flammable gas releases on building occupants are based on the concentration of gases predicted to occur at the building. Results are reported in terms of concentration categories (> UFL, > LFL, or > ½ LFL for each building, if applicable) or, in the case of a BLEVE, in terms of thermal radiation levels. Toxic impacts are assessed in terms of classic end point thresholds (ERPG and IDLH concentrations). Results are reported in terms of the most severe end point predicted to occur at each building.

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[6] Baker, Q. A., M.J. Tang, E. A. Scheier and G. J. Silva, "Vapor Cloud Explosion Analysis," 28th Annual Loss Prevention Symposium, July 19, 1994.
[7] Baker, Q. A., C. M. Doolittle, G. A. Fitzgerald and M. J. Tang, "Recent Developments in the Baker-Strehlow VCE Analysis Methodology," 31st Loss Prevention Symposium, March 9-13, 1997.

5.0 RESULTS

5.1 Dispersion Results

This section summarizes dispersion results obtained from the model. Figure 5 and Figure 6 show a sample cloud side view and overhead view for the downwind distance to ½ LFL, LFL, and UFL for release case P-04/F2. Dispersions for all the cases and meteorological conditions are available from BakerRisk, and accounted for in subsequent blast calculations and plots, but are not specifically reported in this document.

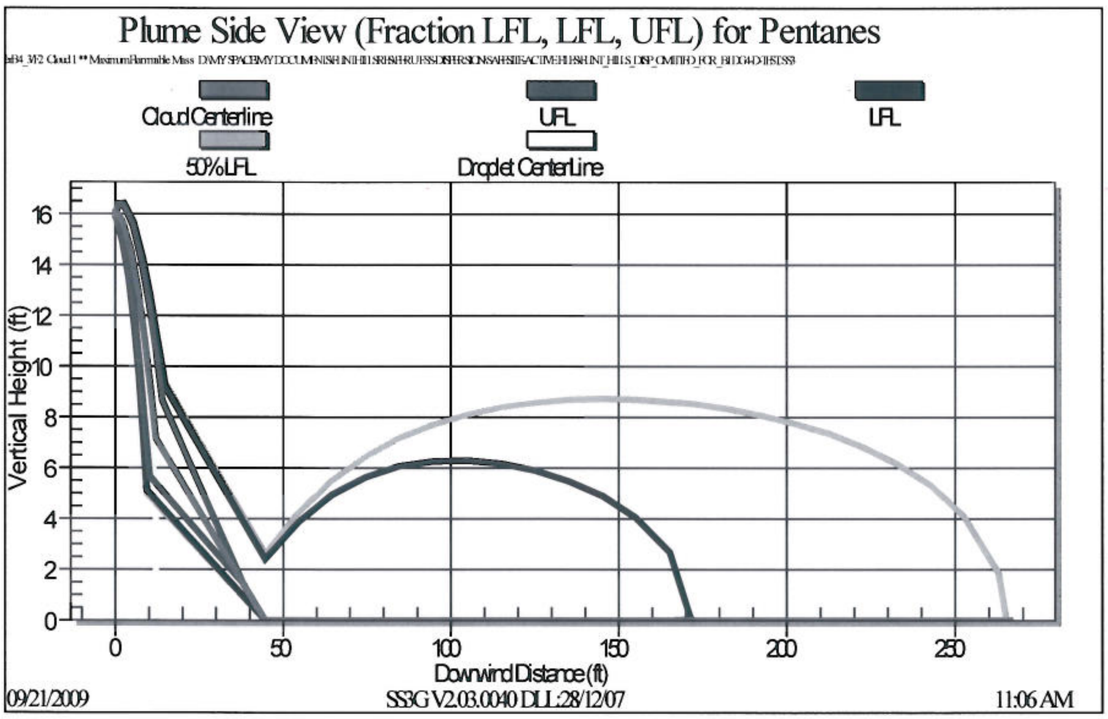
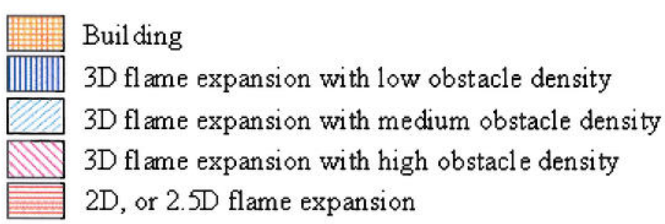


Figure 5: Sample Side View of Vapor Cloud, Scenario P-04 at F2 Conditions

FHRPRU001707

Figure 6: Overhead View of Vapor Cloud for Example, Scenario P-04 at F2 Conditions

SafeSite$_{3G}$® plots, such as Figure 6, use the following legend:



In addition to tabulating dispersion results and showing side view or plan views of such releases, it is also possible to show 3D views of releases (see Figure 7). As discussed above, while every release case included in this study can be viewed in many ways, only one sample 3D view is shown. Note that if the release had blown into other areas of congestion and confinement, the blast loads experienced would be different.

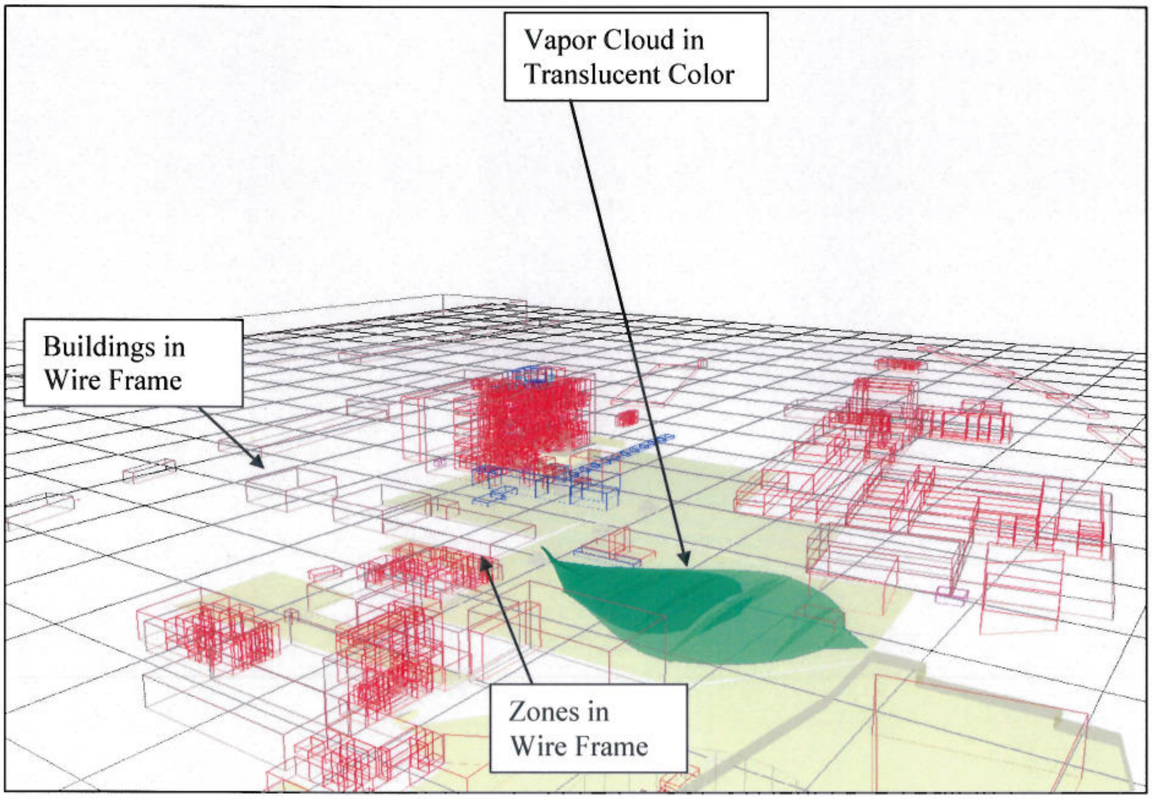


Figure 7: Sample 3D View of the Vapor Cloud, Scenario P-04 at F2 Conditions

The distances to the flammable limits are shown in Table 3:

Table 3. Distances to Flammable Limits

Scenario	Distance to Concentration (feet)			Weather
	UFL	LFL	½ LFL	
S-01-Barge2Water	250	315	380	F2
S-02-Unload	180	240	360	F2
S-03-Storage	160	270	380	F2
S-04-TransferPP	50	80	120	F2
S-05-TransferB4	360	520	650	F2
S-06-PilotPlant	-	-	-	-
S-07-Bldg4	-	-	-	-
P-01-Truck/Rail	100	280	410	F2
P-02-Storage	80	250	420	F2
P-03-TransferPP	6	17	28	F2
P-04-TransferB4	75	195	290	F2
P-05-PilotPlant	-	-	-	-
P-06-Bldg4	-	-	-	-
PR-01-Hose	20	100	220	F2
R-01-LPReliefPP-set	3	140	180	D5
R-01-LPReliefPP-peak	2	8	120	D5
R-02-HPReliefPP-set	10	70	125	F2
R-02-HPReliefPP-peak	15	85	150	F2
R-03-LPReliefB4dump	50	110	160	F2
R-04-HPReliefB4	20	95	155	F2
R-05-LPReliefB4top	40	150	720	F2

Note that the pentane releases appear to have smaller effect areas than the comparable styrene releases. This is attributed to the fact that the release rate from the pentane events is much more severely limited by the capacity of the upstream pump. It is assumed that an exposed individual could be exposed to a fatal dose of thermal radiation within the LFL distance. LFL distances are also used to determine the portion of the gas cloud that can contribute to an explosion event, discussed in the next section.

5.2 Explosion Consequences

BakerRisk used its facility assessment code[8] $\text{SafeSite}_{3G}^{®}$ to predict blast loads and evaluate building damage from explosions. $\text{SafeSite}_{3G}^{®}$ employs a release and dispersion model integrated with the most current blast load model for evaluating vapor cloud explosions.

[8] $\text{SafeSite}_{4G}^{®}$, Baker Engineering & Risk Consultants, 2009.

The "TNT" Equivalence" method was used to evaluate peroxide explosion, since this is more representative of the 'point source' location of discrete peroxide inventories. Building damage prediction models based on field tests and accident inventigation data are also incorporated in the SafeSite$_{3G}$® software to allow automatic building damage predictions for a given blast load.

The external releases were assessed with SafeSite$_{3G}$® by first calculating the flammable mass in a vapor cloud through dispersion modeling, and then predicting blast loads using the Baker-Strehlow-Tang methodology.[9,10,11] The flame speed of the predicted vapor cloud explosions were based, in part, on the degree of equipment congestion and confinement in the areas near the scenarios. A more detailed explanation of explosion consequence modeling is provided in Appendix A.

A composite overpressure contour for the site is provided in Figure 8, and a composite impulse contour in Figure 9. Individual overpressure and impulse plots for the most significant individual scenarios are provided in Appendix C. A review of these plots demonstrates that the controlling explosion incidents are different for each part of the site. However the contours overlap, and so elimination of one scenario does not necessarily mean that the remaining hazards are insignificant.

The overpressure contours are free-field overpressures due to confinement and congestion, and the potential for reflected blast waves of the actual overpressure on a given surface of a building can be as much as twice the free-field overpressures depicted in the contour maps shown in these figures. It should be noted that the contours shown on the maps depict discrete values of constant overpressures, and that the overpressures continuously increase, from each lower overpressure contour to the next higher contour.

It can be seen that the peroxide storage house explosion dominates much of the overpressure profile. It is noted that it is unlikely that all the peroxide would explode at the same time; this is a function of the spacing of individual peroxide pallets, the reason the peroxide dried out, and other factors. The effect that the amount of peroxide in an explosion has on the results was tested, and is reported in the next section.

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[9] Baker, Q. A., Tang, M. J., Scheier, E. A., and Silva, G. J., "Vapor Cloud Explosion Analysis," 28th Annual AIChE Loss Prevention Symposium, Atlanta, GA., April 19, 1994

[10] Baker, Q.A.; Doolittle, C.; Fitzgerald, G.A.; Tang, M.J., "Recent Developments in the Baker-Strehlow VCE Analysis Methodology", 31st Annual Loss Prevention Symposium, American Institute of Chemical Engineers (AIChE), March 1997.

[11] Tang, M.J.; Baker, Q.A., "A New Set of Blast Curves from Vapor Cloud Explosions", 33rd Annual Loss Prevention Symposium, American Institute of Chemical Engineers (AIChE), March 1999.

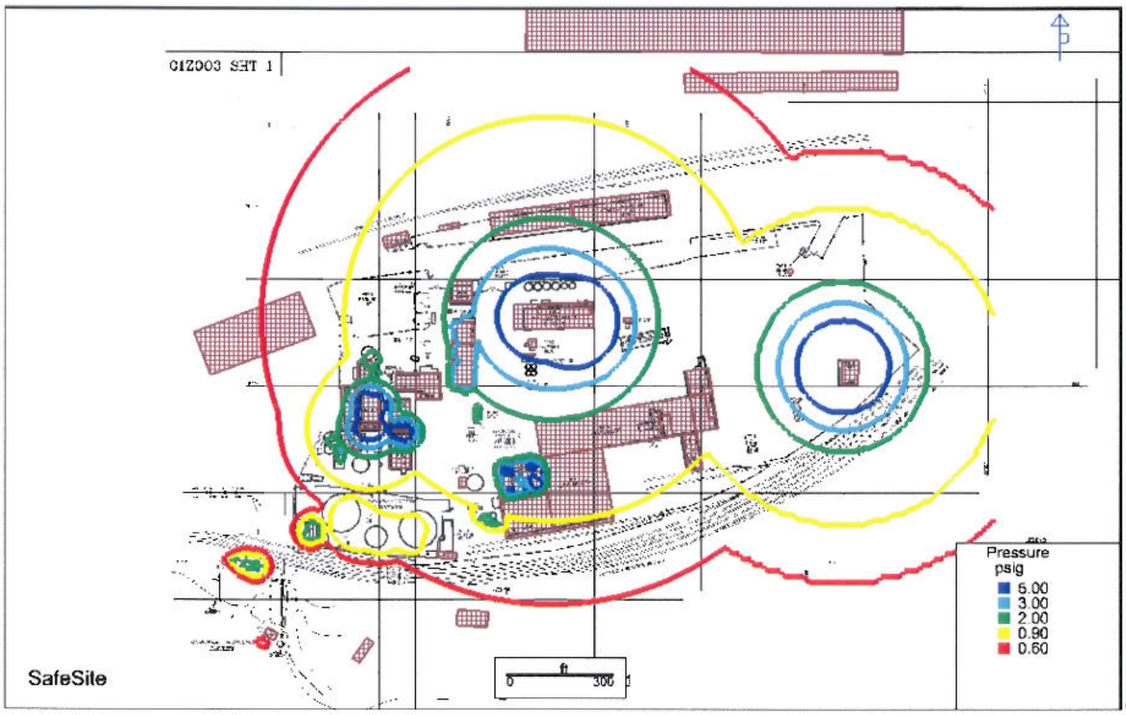

Figure 8: Composite Free-Field Overpressure Contours

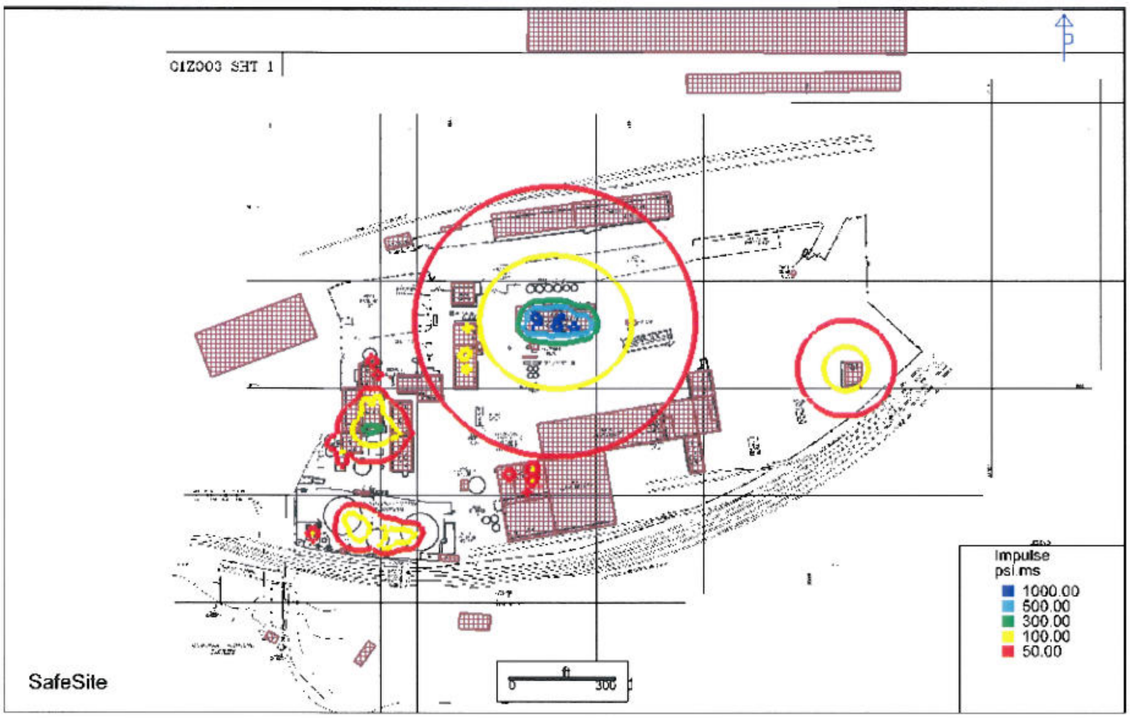

Figure 9: Composite Free-Field Impulse Contours

5.3 Building Damage Levels

Information on the applied blast load history (blast overpressure together with the duration of exposure) and structural design was used to determine the building damage level (BDL) for each building listed in Table 1. A definition of the building damage levels is provided in Table 4. The BDL for each building was predicted based on empirical relationships between the blast loads and observed building and component damage levels developed by BakerRisk for a wide range of common industrial building types. The damage prediction method is based on observed blast damage to overall buildings and building components during industrial explosion accident investigations and blast testing on structural components, where both applied blast loads and resulting blast damage are known.

Table 5 provides the predicted building damage level for each building predicted to experience a BDL level exceeding 2a. BDL of 2a is generally considered the cutoff damage level of interest since the occupant vulnerabilities (to life-threatening injuries) are less than one in 10,000 for a BDL of 2a, but greater than one in 100 for BDL 2b. Thus, a BDL of 2a is generally considered acceptable, but a 2b or greater BDL is usually considered for mitigation for occupied buildings.

Table 4. Definitions of Building Damage Levels

Building Damage Level	Summary of Potential Damage
BDL 4 – Building Collapse	Primary and secondary structural members will fail or sustain major damage resulting in building collapse
BDL 3 - Major Building Damage	Walls facing the blast will fail while other walls have compromised structural integrity. This may cause eventual collapse of the building. Repair of this building is not practical
BDL 2b (aka 2.5) - Heavy Building Damage	There is widespread building damage. Walls facing the blast will sustain major damage while other walls and the roof sustain moderate damage. Building repair may not be practical in some cases.
BDL 2a (aka 2) -Moderate Building Damage	There is localized building damage. Walls facing the blast will sustain moderate damage while other walls and the roof sustain minor to moderate damage. The building can be repaired and reused. Window breakage and fallen overhead items are hazards.
BDL 1 – Minor Building Damage	Walls may or may not sustain the onset of visible damage. Repairs are necessary for cosmetic reasons only.

Table 5. Maximum Building Damage Levels and Sources, for Buildings with Predicted Building Damage Level (BDL) Greater than 2a

Building	Section	Max BDL	Scenarios Impacting Building
Administration Building	1 story warehouse	3	P-06
Bead Recovery Building		4	P-06
Boiler Room		2b	P-06
Building 1		2b	P-06
Catalyst Building		4	PS
Chips	Polymerization	2b	P-06
Chips	Pelletizing Area 1st Fl	2b	P-06
Chips	Pelletizing area 2nd Fl	2b	P-06
Contractor's trailer 1		2b	P-06
Diesel / Diesel Oil Buildings		4	P-06
East Guardhouse		2b	PS
EPS - Building 4	Main building	4	P-06, S-07
EPS - Building 4	Reactor Control Room	4	P-06,S-07, PSB4
EPS - Building 4	Motor Control Room	4	P-06,S-07, PSB4
Flare Building		3	P-06,PSB4
Locker Room Building		2b	P-06
Maintenance Building	2 story section (N)	3	P-06
Maintenance Building	1 story section	2b	P-04, P-06
Maintenance Building	Contractor's Break Room	3	P-06
Pilot Plant		4	P-05
Poly Building 2		3	P-05
Poly Building 3		2b	S-03, P-05, P-06
Propane Tank Fill House		3	S-03,P-05,P-06
Refrigeration House		2b	P-05
Storage3 Building 8		3	P-06
TD Lab Building		4	S-03, P-05
Warehouse adjacent to TD Lab	Similar construction to TD Lab	4	P-05, S-03, PR-01, P-04
Waste Water Treatment Bldg		4	P-05
Water Treatment Building		3	S-03,P-05,P-06

Appendix D shows the controlling blast loads on each side of each building with a Building Damage Level of 2.5 (2b) or greater. This information is of great benefit to the structural engineer in determining the feasibility and cost of implementing structural upgrades.

5.4 BLEVE

A BLEVE event was considered credible for the pentane storage bullets. For this assessment, the radiation distance due to a fireball resulting from the failure of a completely-full pentane bullet was modeled.

Figure 10 shows the thermal radiation that would result from this event.

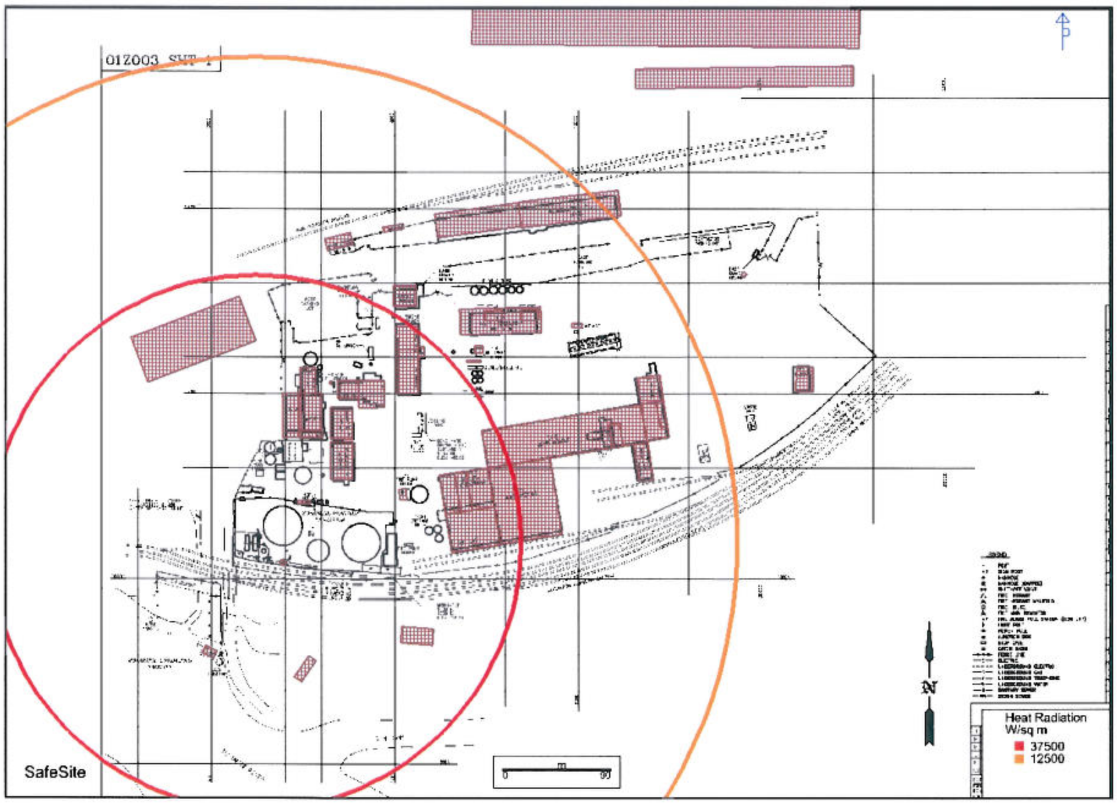

Figure 10. Thermal Radiation Resulting From BLEVE of Pentane Bullet

The impact of these levels of thermal radiation on <u>outdoor</u> people and equipment are described in several sources including the UKAEA (Figure 11) and World Bank (Table 6) on the following page. However, it is expected that building occupants would not be harmed for two reasons:

1. A BLEVE takes many minutes to develop, and people forewarned of the BLEVE possibility would be instructed to evacuate the area first;
2. If the BLEVE did occur, any people remaining inside a building would be sheltered from its thermal radiation. If a building caught fire, the occupants should be able to evacuate safely since the BLEVE fireball would be present for only a few seconds.

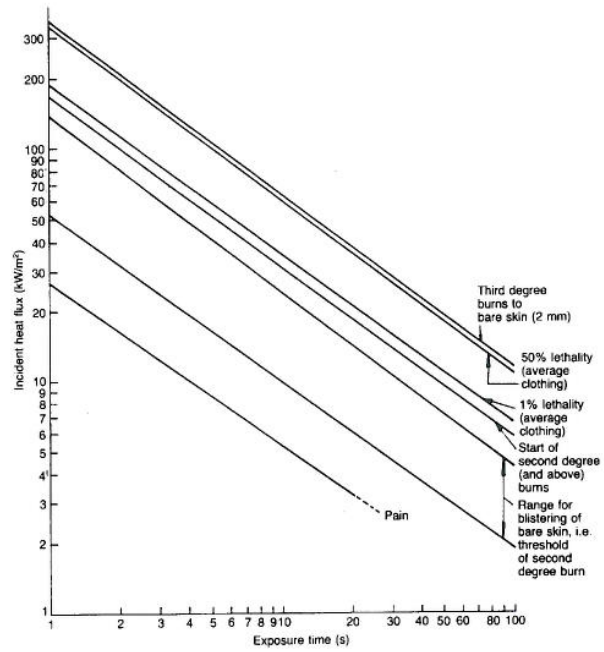

Figure 11. Time to Levels of Discomfort and Injury Due to Heat Radiation[12]

Table 6. Effects of Thermal Radiation on Equipment[13]

Radiation intensity (kW/m^2)	Observed effect
37.5	Sufficient to cause damage to process equipment
25	Minimum energy required to ignite wood at indefinitely long exposures (nonpiloted)
12.5	Minimum energy required for piloted ignition of wood, melting of plastic tubing
9.5	Pain threshold reached after 8 sec; second degree burns after 20 sec
4	Sufficient to cause pain to personnel if unable to reach cover within 20 s. however blistering of the skin (second degree burns) is likely; 0% lethality
1.6	Will cause no discomfort for long exposure

[12] Hymes, L., "The physiological and pathological effects of thermal radiation," UKAEA SRD R275, 1983.
[13] World Bank Technical Paper No.55 (1985). *Techniques for Industrial Hazards – A Manual*

5.5 Toxic Results

Some of the styrene events modeled do not develop significant flammable vapor clouds, and are excluded from further discussion for fire and explosion effects. However, styrene can have toxic and nuisance impact to people, and so these potential impacts are discussed next.

5.5.1 Human Health Outcomes

Following are some reported acute toxicity measures for styrene:

Table 7. Styrene Toxicity Measures

Measure	Value	Definition
Immediately Dangerous to Life or Health (IDLH)	2980 mg/m^3 (700 ppm)	NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.
ERPG-3	1000 ppm	The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.
AEGL-3	1900 ppm (10 min, 30 min)	The airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Toxic fatality vulnerability probabilities are usually quantified using a "probit" equation that relates the probability of fatality to the exposure dosage (duration/ concentration combination). A human fatality probit equation for styrene is not available, presumably because styrene is less toxic than many chemicals, and is also less volatile and so provides more opportunities for escape. Note that for most toxic chemicals, it takes several times the IDLH concentration to reach the threshold of fatality impacts for healthy individuals.

An example dispersion is provided in Figure 12, which reports distances to ERPG-3.

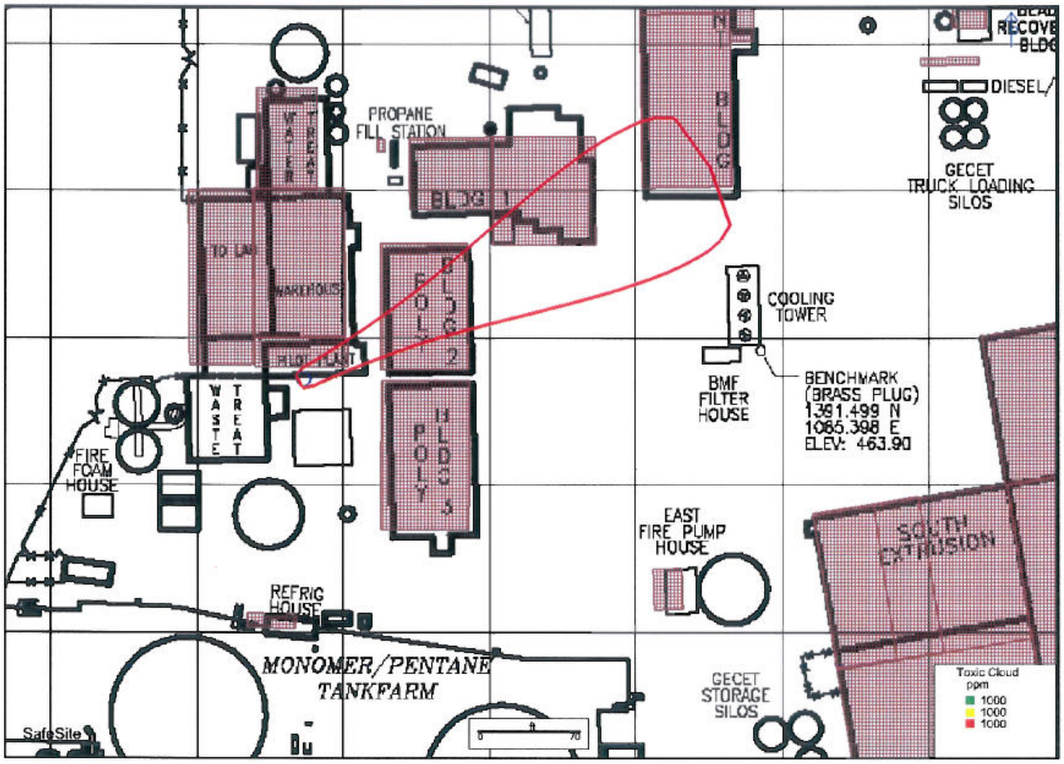

Figure 12: Styrene Concentration Plumes, Scenario R-01

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Table 8 provides distances to ERPG-3 levels as input to determine whether buildings can be considered as shelters-in-place. The distances are also presented graphically in Figure 13.

Table 8. Distances to ERPG-3 Styrene Concentrations

Source Name	Weather Name	Distance To ERPG-3 (ft)	Time To Reach ERPG-3 (s)
R-01-LPReliefPP-peak	F2	264	110
R-01-LPReliefPP-peak	D5	319	21
R-01-LPReliefPP-set	F2	114	20
R-01-LPReliefPP-set	D5	227	0
R-03-Styrene at 205F-typ dump case	D5	108	4
R-03-Styrene at 205F-typ dump case	F2	230	53
R-05-LPReliefB4top	D5	500	0
R-05-LPReliefB4top	F2	857	47
S-01- Barge2Water	D5	311	2
S-01- Barge2Water	F2	449	9
S-02-Unload	D5	354	10
S-02-Unload	F2	476	94
S-02-Unload_1	D5	331	9
S-02-Unload_1	F2	458	96
S-03-Storage	D5	286	0
S-03-Storage	F2	508	0
S-04-TransferPP_1	D5	86	0
S-04-TransferPP_1	F2	143	34
S-05-TransferB4_1	F2	815	150
S-05-TransferB4_1	D5	604	18

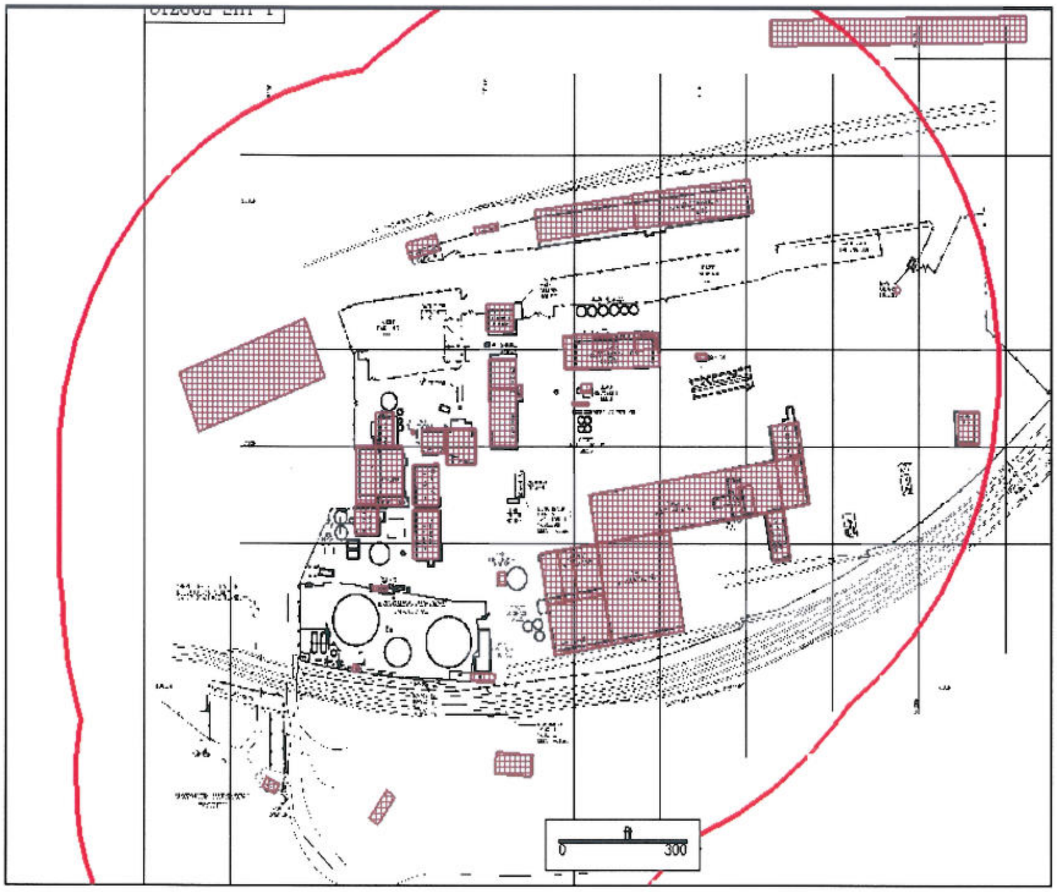

Figure 13. ERPG-3 Contours for Peru Site

Given proper warning, it is expected that all site personnel would be able to simply evacuate the site without significant impacts for these events.

5.5.2 Odor Thresholds

Styrene is reported to have an extremely low odor threshold of 0.32 ppm.[14] This means that its nuisance potential can extend well beyond its flammable hazard or toxic health hazard range. As an example, consider Scenario S-01, a spill from a barge onto water. This event does not pose any explosion hazard because the styrene does not disperse above the water level in flammable concentrations. For similar reasons it also does not pose a human health risk. However, it is still capable of being detected by smell several miles away, as shown in Figure 14 below.

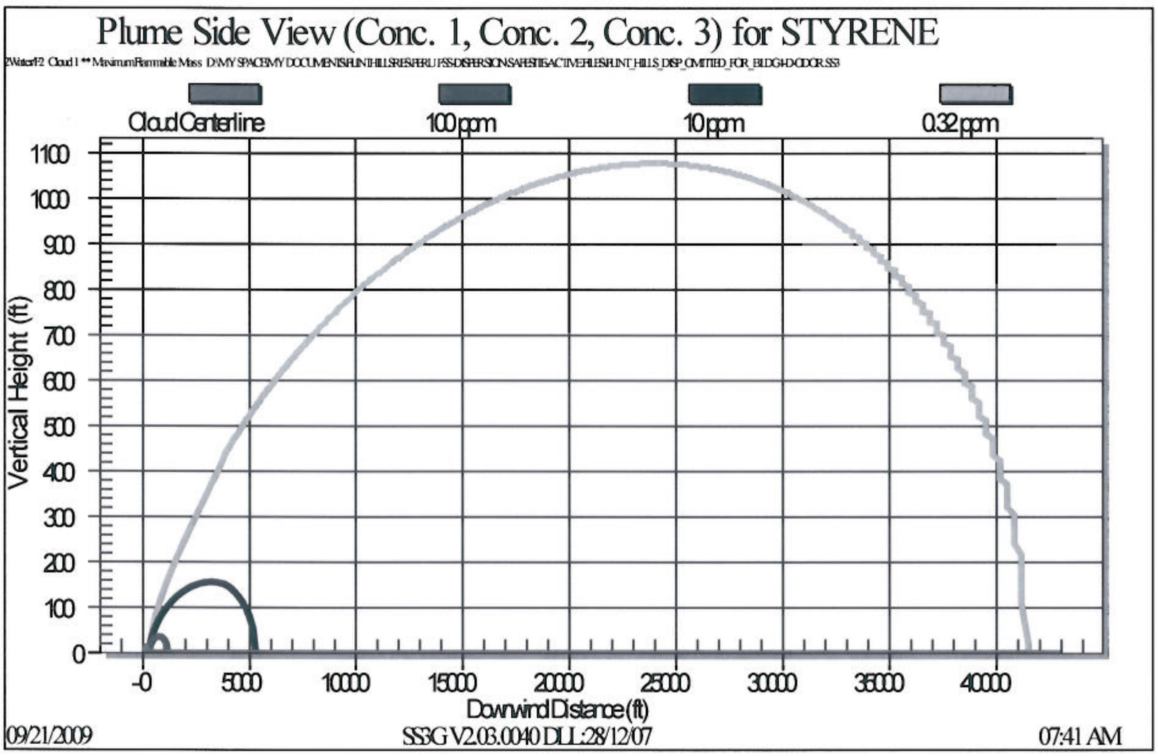

Figure 14: Styrene Odor-Toxic Concentration Contours

[14] J.E. Amoore and E. Hautala, "Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatilities of 214 industrial chemicals in air and water dilution," Journal of Applied Toxicology, 3(6):272-290, 1983.

6.0 CLOSURE OF PHA ACTION ITEMS

One goal of this project was to address related action items from the most recent Process Hazards Analyses. The action items, and how this report addresses them, are listed below.

1. **Lynx Action Item *"2008 PHA Revalidation - Building 4 #107867"*-** Consider modeling intentional dump and uncontrolled dump of reactor contents to concrete containment pit with PHAST (Process Hazard Analysis Safety Tool) software [or equivalent] to determine if additional safeguards are required.

   Action Plan: Complete Fauske/BakerRisk Modeling evaluations.

   Siting Project Response - *The effects of an intentional dump from a Building 4 reactor (that is, where the batch has gone off-spec and the batch is dumped according to the prescribed protocols) is described as a standard case (Scenario R-03) in this report, with consideration of the reaction kinetics that would take place in the reactor and in the pit during such an event.*

   The latest thinking from the site is that the odds of an uncontrolled reaction/dump should be very small since there is the SIS that trips just a few degrees higher than the controlled dump temperature. Regardless of the likelihood, the effects of an uncontrolled dump have been analyzed with respect to a scenario in which mixing is lost and a batch is dumped styrene-first into the pit. For a range of temperatures, the dispersion from the pit (based on evaporation only) has been calculated to the flammable limits (Appendix B).

   The software used for this modeling and the modeling below is BakerRisk's SafeSite$_{3G}$®, which uses the same fundamental principles as PHAST and whose key developer was also a developer of the PHAST software.

2. **Lynx Action Item *"2008 PHA Revalidation - Building 4 #107875"* -** Consider modeling uncontrolled dump of reaction contents through rupture disk on top of reactor during pentane addition and/or cure with PHAST (Process Hazard Analysis Safety Tool) software[or equivalent] to determine if additional safeguards are required.

   Action Plan: Complete Fauske/BakerRisk Modeling evaluations.

   Siting Project Response - *The effects of a high pressure pentane vapor relief from a Building 4 reactor have been modeled in both the Fauske report and in this current report. In the current study, the event (Scenario R-04) results are integrated into the study as a whole and not called out separately since they result in less severe outcomes than some others.*

3. **Lynx Action Item "*2008 PHA Revalidation – TD[Pilot Plant] #107899*" -** Consider modeling vapor cloud dispersion calculations from the reactor high pressure relief line. Contingent on results of BakerRisk/Fauske modeling.

   Siting Project Response - *The effects of a high pressure pentane vapor relief from a pilot plant reactor have been modeled in both the Fauske report and in this current report, with the current report considering both peak pressure and set pressure discharges. In the current study, the event (Scenario R-02set/peak) results are integrated into the study as a whole and not called out separately since they result in less severe outcomes than some others.*

4. **Lynx Action Item "*2008 PHA Revalidation – TD[Pilot Plant] #107903*" -** Consider modeling of dropping reactor contents to pit using PHAST (Process Hazard Analysis Safety Tool) software[or equivalent]. Procure PHAST software/run evaluation/generate findings and action items.

   Siting Project Response – *The effects of dumping a pilot plant reactor to the pilot plant pit were modeled in* ***scenarios R-01-LPReliefPP-set & R-01-LPReliefPP-peak.*** *Note that it is current practice to allow a runaway reaction to run to completion* in situ *in the reactor.*

7.0 Hazard Mitigation Options

7.1 Principles of Hazard Mitigation for Peru Site

The following are suggestions as to potential means of minimizing hazards at the site. But it should be remembered that the *risks* of these hazards may already be at tolerably low levels, given the safeguards that are already in place at the site. The ideas below are mainly "technical" in nature, and it is quite possible that other "non-technical" measures (e.g. procedural changes, increased inspections, inventory management) would be more cost-effective in achieving risk reductions. The following items are only offered for FHR's consideration, and there is no implied requirement to institute any of these measures.

7.2 Vapor Cloud Explosion Mitigation

The necessity of taking risk mitigation measures depends largely on the site's confidence in its release prevention programs. Blast mitigation in production facilities such as Peru typically considers the following with respect to minimizing the likelihood or strength of an explosion:

- having good general release prevention/PSM programs,
- having good controls on reactors prone to runaway conditions
- having sufficient ventilation in vulnerable buildings
- removing out-of-service equipment and buildings

Regarding the last bullet item, the removal of the unused Poly 2 and Poly 3 buildings would undoubtedly be a benefit in reducing confinement/blast wave reflection in that area. However, the level of resolution of the model used in this study was insufficient to quantify the degree of benefit that would result; a more sophisticated model can be employed to determine this, if necessary.

With regard to minimizing the impact if an explosion does occur, facilities typically consider:

- relocating people to less vulnerable locations where practical
- upgrading occupied buildings to resist the postulated blast loads.

This subject is discussed further in Sections 7.3 and 7.4.

7.3 Structural Upgrade Options - Overview

A brief review of the structural types used in the plant shows that none of the buildings have been specifically designed for blast events. In some cases, the buildings are predicted to have a BDL of 4, which implies that complete collapse under the evaluated scenarios is quite possible. Additionally, a number of adjacent buildings located outside the plant limits were surveyed and the predicted structural impact of the postulated blast events was included in this report. This information is provided for plant management information only.

Based upon the current analysis, the following structural mitigation options should be given consideration by site management. **Note that implementing these measures is not a *requirement* of any regulation or standard. It is expected that in the vast majority of cases no change will be needed because either: (a) the building is not regularly unoccupied, and/or (b) the hazard to the building can be addressed more effectively by means other than structural mitigation.**

1. Use of composite contours provided in Figure 8 should be done with care, as these are free-field contours and the potential blast load on any structural surface can be more than twice the value, due to reflected waves and factors based upon equipment and building configurations.
2. Given the predicted structural behavior of typical trailer structures, it is recommended that all temporary trailers are located outside the 0.6 psi overpressure contour (red line in the contour map).
3. Consider reducing the occupant vulnerability of the buildings predicted to have a BDL of 2.5 or higher with one of the following methods:
   - Depopulate the building.
   - Replace building with a building designed for the worst-case postulated loads.
   - Structurally strengthen the existing structure to resist worst-case postulated loads.
4. Multiple buildings on-site contain windows and/or doors that pose a hazard to interior occupants; options presented in this report should be reviewed for methods to mitigate this hazard.

7.4 Building Upgrade Options for Explosion Hazard Mitigation

The structural upgrade information presented in the following section is preliminary and not intended to be used for construction drawings. A detailed blast design must be performed prior to any construction of blast upgrades to the building. The provided conceptual upgrades are provided for planning purposes only. These options assume the buildings need to be upgraded; however, a risk analysis may demonstrate that even buildings predicted to fail could remain as is, providing their overall risk is low enough due to low probability events and low occupancy.

The blast load history used in the analysis of the existing structures and the design of the conceptual upgrades is assumed to have the shape shown in Figure 15, where it immediately rises to the peak pressure and then decays linearly to atmospheric pressure over the duration time, t_d. The area under the pressure vs. time graph of the blast load is the blast load impulse (i), as shown in Figure 15.

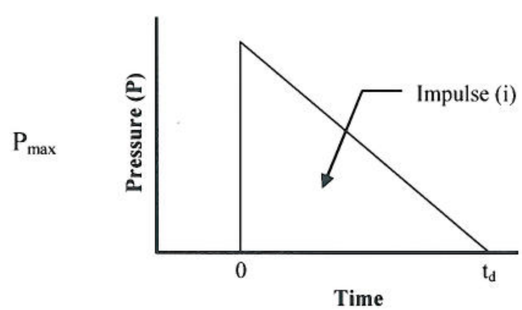

Figure 15. Assumed Shape for Blast Load in Blast Analysis

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7.4.1 Administration Building

This building consists of two additions, an older wooden frame and a newer steel frame. The timber columns show moisture damage over the lower level which reduced their capacity. The exterior walls are of load-bearing brick construction. The highest predicted loads reach 4.58 psi over the south face. Mitigation options should include transverse wood and metal frame strengthening by means of steel sleeves and plates, wall reinforcement consisting of FRP liners over the inside faces or steel tubes attached to the outside faces, roof upgrade by means of added intermediate purlins and / or trusses, replacement of essential exterior access doors with blast resistant doors, protection of windows with safety film or plastic catch sheets, and blockout of nonessential windows and doors, particularly over the south side of the building.

7.4.2 Bead Recovery Building

This is a small building subject to extremely high loads (up to 15.66 psi over the East face). For this level of blast loads, the most cost effective option is to relocate personnel to other buildings or replace this building with a blast resistant module.

7.4.3 Boiler Room / Building 1

The Boiler Room is a single story steel framing building with concrete masonry exterior walls. The worst-case scenario load is 3.12 psi over the east face. For this moderate load level, the typical upgrade consists of reinforcing the exterior walls with steel tubes, and upgrade of doors and windows as needed. The adjacent two-story Building 1 is scheduled to be demolished and therefore we assume no upgrade of that building shall be necessary. The Poly-Foreman Office is a small modular building located south of the Boiler Room. For this type of construction and predicted load (on the order of 2 psi) it would be cost-effective to relocate the occupants to another building or replace this building with a blast resistant module.

7.4.4 Catalyst Building

This is a load bearing CMU walls structure with open web steel joists and corrugated metal roof deck. Some of the postulated blast scenarios are internal to this building. While SafeSite$_{3G}$® is not intended to accurately model the internal wall and roof pressures due to such scenarios, the order of magnitude (in excess of 100 psi) indicates that the existing building cannot be effectively upgraded as an occupied building, but a heavy reinforced concrete cell could be built inside the existing enclosure to contain the potential blast sources and minimize the impact upon other buildings.

7.4.5 Chips Building

This construction is part of the EPS Warehouse, with heavy steel framing and a combination of metal siding and CMU exterior walls. The predicted loads reach up to 2.59 psi over the west side. Despite the heavy loads, due to the strong framing and its low height-to-width ratio, this building can be upgraded by strengthening the most heavily loaded walls with FRP liners or additional steel girts and purlins (depending on the type of construction) over the interior, adding steel tubes to the exterior side of walls subject to moderate loads, adding roof purlins and members as needed and reinforce the framing connections and bracing if necessary.

7.4.6 Diesel Oil Buildings

These small constructions are subject to loads up to 10.35 psi and there is no cost-effective upgrade solution this type of construction for this level of loading. If this building was considered "occupied", options to address this issue would include relocating personnel or consolidate this and the nearby Bead Recovery Building into a single blast resistant module.

7.4.7 East Guardhouse

This small modular building is subject to loads up to 3.04 psi and there is no cost-effective upgrade solution to upgrade this type of construction for this level of loading. Assuming a security booth is needed at that location and cannot be moved elsewhere, replacing the existing booth with a blast resistant construction fitted with heavy security windows is an option.

7.4.8 EPS – Building 4

This is a multistory building of steel framing and exterior CMU wall construction. Some of the postulated scenarios are internal to this building. While SafeSite$_{3G}$® is not intended to provide an accurate estimation of internal wall and roof pressures from internal blasts, the order of magnitude of the worst-case scenario pressures (exceeding 50 psi) indicate that the most cost effective solution is to contain the potential blast sources inside heavy reinforced concrete cells. These cells need to be modeled with specific internal pressure design tools.

Under the existing condition, the modular Reactor and Motor Control Rooms located on the upper floors of Building 4 are predicted to collapse. Similar to what was described for the main building envelope, the suggested retrofit involves enclosing the potential blast sources in a heavy concrete cell.

7.4.9 Flare Building

With a highest load of 8.12 psi, no cost effective upgrade can be performed. Personnel relocation is suggested; or if possible, consolidate with new construction for the nearby Bead Recovery and Diesel Oil buildings.

7.4.10 Locker Room Building

This is a steel framing construction cladded in corrugated metal. A load of 5.44 psi over the east face is the worst-case scenario. This type of building can be effectively upgraded by means of additional girts, purlins and connections over the walls and roof, and blocking out or protecting the windows.

7.4.11 Maintenance Building

This building consists of a one story warehouse of heavy steel framing with corrugated metal siding, an added second story over the east side, and an add-on Contractors Breakroom of lighter construction on the south face. The highest predicted load is 5.99 psi over the east side. This building can be upgraded in a cost effective manner, similar to what was suggested for the Locker Room (see §7.6.10). The Contractor's Breakroom should be relocated, if feasible and the add-on portion of the Maintenance Building should be abandoned.

7.4.12 Pilot Plant

This multistory building consists of heavy bolted steel frames with transite wall panels and steel grating intermediate floors. The highest load is 19.26 psi, applied on the south side. To effectively upgrade this building, all transite paneling should be removed and replaced with steel cladding. In the process, once the wall and roof framing is exposed, additional steel purlins and girts should be installed. Given the height of the building and the predicted loads, additional lateral bracing may be required, which can be installed when the existing skin is removed.

7.4.13 Poly Buildings 2 and 3

It is our understanding that these two buildings shall be demolished, and therefore no upgrades are recommended.

7.4.14 Refrigeration House

The highest predicted load is 1.95 psi over the North face. This wood-framed building with transite wall panels should be vacated or replaced with a blast resistant module.

7.4.15 Storage 3 Building 8

This is a wood-roof-and-columns construction, with load bearing clay brick walls. For the worst-case scenario loads of 2.37 psi over the east face, upgrades may not be cost effective. We recommend relocating the building occupants.

7.4.16 TD Lab Building and Adjacent Warehouse

These high bay load bearing CMU buildings, fitted with open web steel joist roofs, are subject to loads of up to 9.54 psi over their east faces. These are heavy loads which would require extensive wall reinforcement, either applying FRP liners over the inside or steel tubes over the outside. Lateral framing will need to be assessed and may require additional steel bracing. Roof trusses and purlins may require to be upgraded with additional members or local reinforcements.

7.4.17 Water Treatment Building

This building shares the same construction type as the TD Lab and is subject to similar forces. Therefore, the upgrade approach should be similar to what was outlined in §7.6.16.

7.5 Windows and Doors

In addition to the hazards from structural components, non-structural components such as windows and doors pose further hazards to building occupants in an explosion event.

7.5.1 Windows

Windows will break as a function of the surface blast pressure, and glass fragments will be thrown into the interior of the building as function of the applied impulse. Windows predicted to fail with high velocity fragments and a launch distance of greater than 10 ft should be considered for upgrades. Multiple buildings in this plant have one or more windows that meet or exceed the minimal upgrade criteria:

In general, upgrade options for glass-debris mitigation include the following:

- Removal of windows that are not needed, block in openings.
- Install window film on the interior face of the glazing and anchor to the window frame
- Install daylight film on the interior face of the glazing with the addition of a catcher bar
- Install a translucent or transparent plastic sheet inside the window, designed to catch glass shards in the event of a blast.

Note that strengthening of the window glazing system may require strengthening of the existing window frame and window frame connections into the building structure.

7.5.2 Doors

Exterior doors can cause vulnerability issues for building occupants in two ways. First, the doors can be blown free from their supports into the building as debris hazards. Second, the doors can become lodged in the doorframes and become inoperable after an explosion event. Multiple buildings in this plant contain one or more doors that respond in the above mentioned manner to the postulated loads.

Upgrade options for doors include:

- Removal of doors that are not needed, block in opening
- Replacing an existing door with a blast resistant door and door frame
- Install cable catch system to prevent door from being thrown into building interior
- Upgrade existing doors structurally, as shown in Figure 16
- Weld stiffeners to the outside face to increase moment capacity
- Weld bar stock to frame to increase the door leaf/door frame bearing area

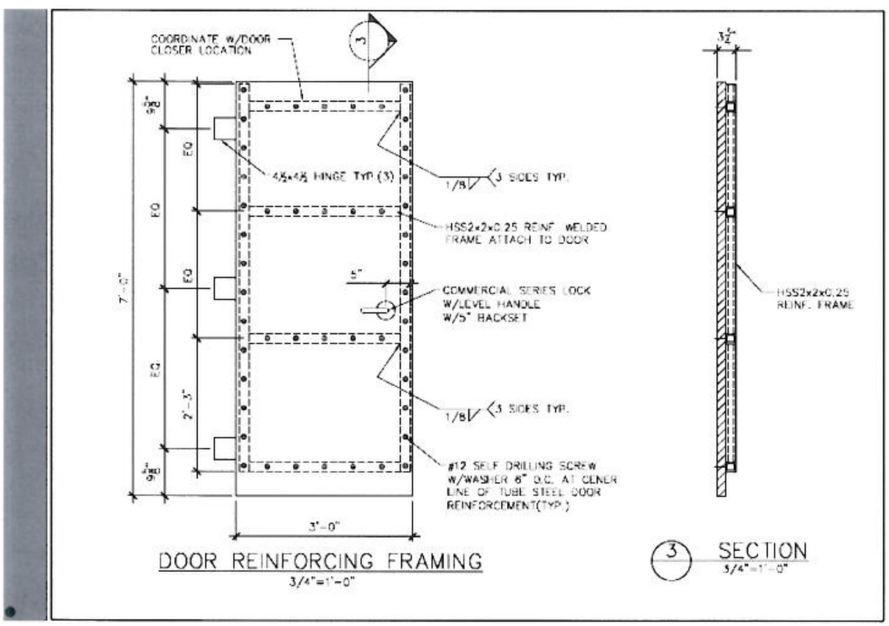

Figure 16. Strengthening of Standard Hollow Metal Door

Structural strengthening of the door system or replacement of the door system with a blast resistant door will require a substantial strengthening of the connections to the building walls. Information on blast door vendors and sample specifications are available from BakerRisk upon request.

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7.6 Peroxide Explosion Hazard Mitigation

Peroxide hazards dominated the explosion profile of much of the site. Originally, the peroxides were modeled on the basis of the entire inventory of benzoyl peroxide exploding in a single event, which was ultimately determined as probably greatly overstating the hazard. However, what the analysis does indicate is the importance of the following:

- Minimizing the amount of peroxide that is located in a single "space" and therefore subject to the same "environment" that could cause it to be exposed to fire, dry out, or otherwise induce decomposition. These measures include minimizing inventory, and separating pallets as much as possible.
- Controlling the peroxide environment, so that is always kept cool, packaging integrity is maintained, and it is not exposed to likely fire sources.

7.7 Fire Hazard Mitigation

Fire hazards to building occupants are typically managed through the following means:

- having good general release prevention/PSM programs,
- having sufficient ventilation in vulnerable buildings to prevent accumulation of flammable gases or dusts
- access to fire response personnel, equipment and firewater supplies
- providing building occupants with warning that a fire is in progress, and with a means of egress from the building that faces away from potential fires

It is assumed that if these measures are in place, building occupants will not be seriously injured due to fires that occur in the process areas.

7.8 Toxic Hazard Mitigation

Toxic releases have the potential to cause concentrations at occupied buildings that are greater than IDLH for many minutes. This includes significant periods after the outside concentration has fallen to zero.

Buildings offer a large measure of protection if windows and external ventilation systems are closed promptly upon release. However, just as a building delays the ingress of toxic gases, it also delays the purging of gases once the hazard has passed. Therefore it is important to know both when an exposure has started and when it has ended. In a "worst-case scenario," an initiating explosion could compromise the integrity of a building, leaving it more vulnerable to toxic releases caused by explosion damage to equipment.

APPENDIX A.
VAPOR CLOUD EXPLOSION CONSEQUENCE METHODOLOGY

This appendix summarizes the vapor cloud explosion prediction methodology used in this study.

A1. Congestion

As a volume of gas combusts, it expands which also forces the unburned gas ahead of it to flow. If there are obstacles in the path of the unburned expanding gas they will induce turbulence in the expanding flow. This turbulence enhances the combustion process through mixing and increased flame surface area. These obstacles are referred to as congestion.

The flame speed and blast wave resulting from a vapor cloud explosion depends on the level of congestion. A higher level of congestion results in a higher flame speed and more severe blast wave. In the Baker-Strehlow-Tang (BST) methodology, congestion is classified into three categories – low, medium and high. Examples of low, medium, and high congestion levels are depicted in Figure A 1 through Figure A 3.

Figure A 1: Example of Low Congestion

Figure A 2: Example of Medium Congestion

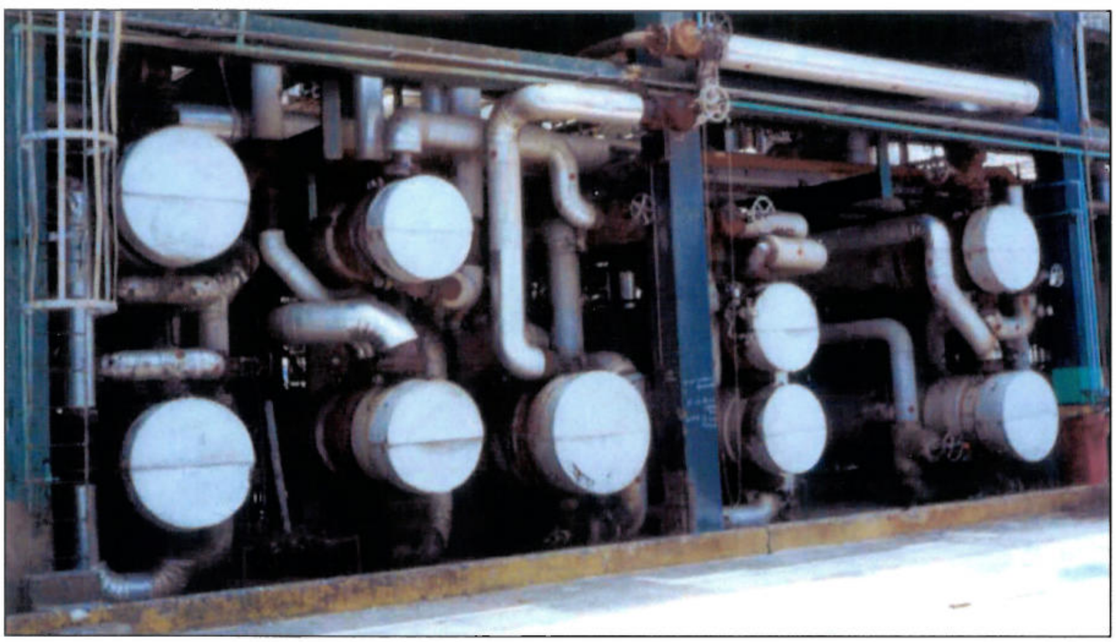

Figure A 3: Example of High Congestion

A2. Confinement

If a roof or other restraint is present, a burning cloud cannot expand in the restrained direction, and gases flow in the remaining directions at a higher rate. This restraint is referred to as confinement since it confines the dimensionality of the combusting cloud's expansion. For example, a solid roof prevents vertical expansion and is considered to be 2D confinement. In the BST methodology, confinement is classified into dimensions in which the cloud is free to expand: 3D, 2.5D and 2D.

The flame speed and blast wave resulting from a vapor cloud explosion depends on the level of confinement. A more confined flammable cloud causes a higher flame speed and more severe blast wave. In the BST methodology, confinement is classified into three categories: 3D (unconfined), 2.5D (confined at a level between 3D and 2D), and 2D (free to expand in 2 dimensions).

Examples of these confinement levels are depicted in Figure A 4 through Figure A 6.

Figure A 4: Example of 3D Confinement

Figure A 5: Example of 2.5D Confinement

Figure A 6: Example of 2D Confinement

A3. Fuel Reactivity

A fundamental property of combustion is the laminar burning velocity (LBV), which describes the reaction rate at which a particular fuel will burn. The higher the burning velocity the more reactive the fuel, therefore the faster it will burn and produce a stronger blast wave. In the BST methodology, fuel reactivity is classified into three categories of LBV – low, medium and high.

The combination of congestion, confinement and reactivity is used to predict an effective flame speed, presented as a Mach number. This Mach number, along with the energy contained in the cloud, can be used to predict pressure and impulse (defined as the integral of pressure over time) by interpolating between the numerically modeled BST blast curves.

Years of research into VCEs through experimental programs, numerical modeling, and literature reviews have produced a proprietary extended version of the BST methodology. BakerRisk has also extended the methodology to account for the effect of multiple volumes of congestion and confinement being involved in a single explosion. This methodology produces blast contours that account for the shape, extents, and variations in the physical congested and confined volumes typical of industrial facilities.

Through the investigation of hundreds of industrial accidental explosions and hundreds of medium-scale experiments, the BST methodology has been refined and verified to provide good predictions of blast loads produced by VCEs.

A4. Overview of Blast Waves and Structural Interaction

As discussed above, the accelerated flame front of the VCE can drive a pressure wave through the atmosphere. Figure A 7 illustrates the propagation of such a wave. Once the wave leaves the source of the explosion (congested volume, pressure vessel or high explosive charge), it may reduce in speed, but the pressure wave will continue to expand out from the source in all directions, decaying in magnitude with distance.

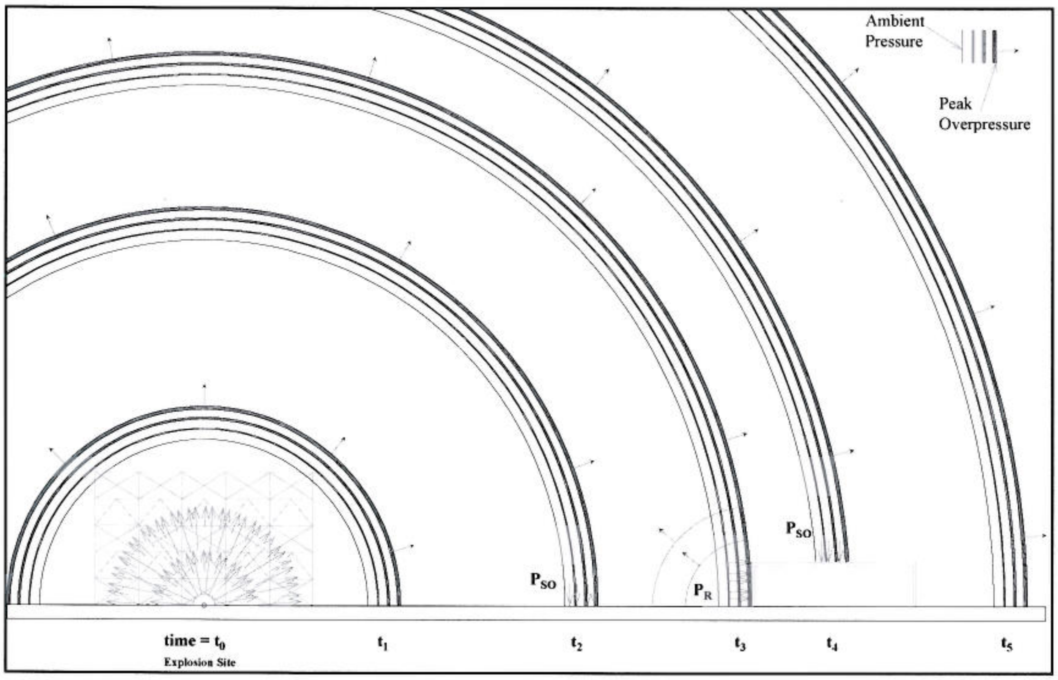

Figure A 7: Pressure Wave Illustration

The blast pressure wave expands as a hemispherical shell of pressure bounded at the bottom by the ground surface. As it sweeps over the ground, this blast wave applies pressure on the ground surface (see Figure A 7 at time t_2). A blast wave traveling over open ground or a flat building roof is an example of a side-on orientation (see time t_4 in Figure A 7). A blast wave sweeping side-on over an area without regard to reflecting surfaces is also called free-field. Blast loads are traditionally illustrated with free field pressure contours.

A blast wave interacting with a building surface will vary in its pressure magnitude depending on the orientation of the blast wave relative to the building surface. A blast wave that loads walls facing the source will produce a reflected blast load. Figure A 7 depicts this at time t_3, when the shock wave strikes the building wall at a normal orientation (i.e. the direction to the explosion is perpendicular to the reflecting surface). This reflection process causes the pressure and impulse to be increased above their side-on values. The result is that the blastward surfaces of a structure receive a higher blast load than the roof, side, or rear walls receive.

Figure A 8 shows the ratio of reflected (P_r) to side-on (P_{so}) pressure over a range of pressures typical for VCEs. From this figure, a ratio between side-on and reflected pressure is found and referred to as the reflection factor. This factor starts at 2 for very low side-on pressures and increases as the side-on pressure increases. For example, at 10 psi, the reflection ratio is about 2.5 and at 20 psi, the ratio is almost 3. This load reflection occurs over the full duration of the wave. Thus, the reflected pressure history is characterized by the peak reflected over-pressure at the start, reducing to ambient pressure over a time equal to the blast load duration.

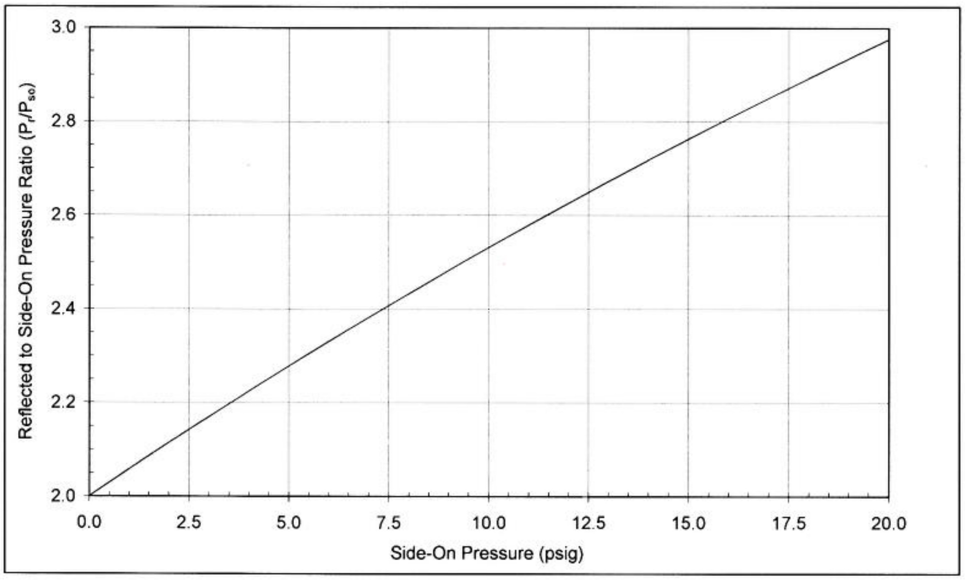

Figure A 8: Reflection Factor as a Function of Side-on Pressure

The relationship shown in Figure A 8 is for a normal reflection of a blast wave by a surface. The reflection factor is reduced when the blast wave interacts with a surface at an oblique angle, with a limit of 1 (no amplification) at a side-on orientation.

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APPENDIX B.
EFFECT OF DISCHARGE TEMPERATURE IN DISPERSION OF STYRENE FOLLOWING A BUILDING 4 REACTOR LOW PRESSURE DUMP (UNMIXED)

B.1 Styrene Polymerization Reaction Kinetics

The previous Fauske report appears to have been based on a thermally initiated reaction, with a rate equation of the following form: $dx/dt = A\,[M]^{1.5}x$, where x is the mass fraction of styrene monomer, [M] is the concentration of styrene monomer in kgmol/m^3, and A is a constant dependent on the styrene mass fraction and the reaction temperature. It is assumed that Fauske followed these kinetics because, using rate constant information from Hui and Hamielec[15] this project replicated the Fauske reaction rates within 10% for test cases that were run.

However, in contrast to the Fauske treatment, FHR notes that in the current operation the catalyzed reaction of styrene to polystyrene follows first-order kinetics:

$$dS/dt = kS,$$

Where S is the concentration of styrene, t is time, and k is a rate constant.

Then,

$dS/S = k \times dt$, which when integrated yields $\ln(S) = kt +$ integration constant.

Since at t = 0 the concentration is the initial concentration of styrene (So), the integration constant is ln (So), and the equation above can be rearranged to yield the following:

$$\mathrm{Ln}\,(S/S_o) = kt$$

"k" follows an Arrhenius form: $k = Ae^{-(Ea/RT)}$

Where A is a constant, Ea is the activation energy, R is the gas constant, and T is the temperature

FHR provided the following constants for "k":

Ea = 122.35 kJ/mole
A = 6.94E13

From this information, a spreadsheet was created that allowed the instantaneous reaction rate to be developed for different temperatures at different points in time. This spreadsheet replicated the reaction "half-life"s reported by FHR at various temperatures, and so was considered to be validated.

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[15] Hui, A.W. and Hamielec, A.E., "Thermal Polymerization of Styrene at High Conversions and Temperatures. An Experimental Study.", J. Appl. Polym. Sci., 16, 749 (1972).

B.2 Evolution of Styrene Vapors from the Dump Pit

To test the effect of a dump of styrene in uncontrolled conditions (release at various temperatures, loss of mixing), a series of modeling runs were performed to estimate the rate of styrene vaporization from a pool in the dump pit. **In this appendix, vaporization is assumed to occur as a result of pool evaporation only, and does not take into account vapors generated by reactions in the pool.**

Following are test cases of styrene dispersion from the Building 4 dump pit. Side views of the dispersions are shown for cases where the releases take place at F2/70F atmospheric conditions. Temperatures shown are those at the point of release from Building 4.

Note that the X and Y axes are not to the same scale.

For more robust atmospheric conditions (D5), the distances to LFL are about 15% lower (at low temperatures) to 50% lower (at high temperatures) than those shown in the following plots.

Note that the in the current mode of operation, the styrene will be dumped while still well-mixed with water. It is expected that the presence of water in the pit will limit the temperature of the styrene above to a nominal temperature about the boiling point of water.

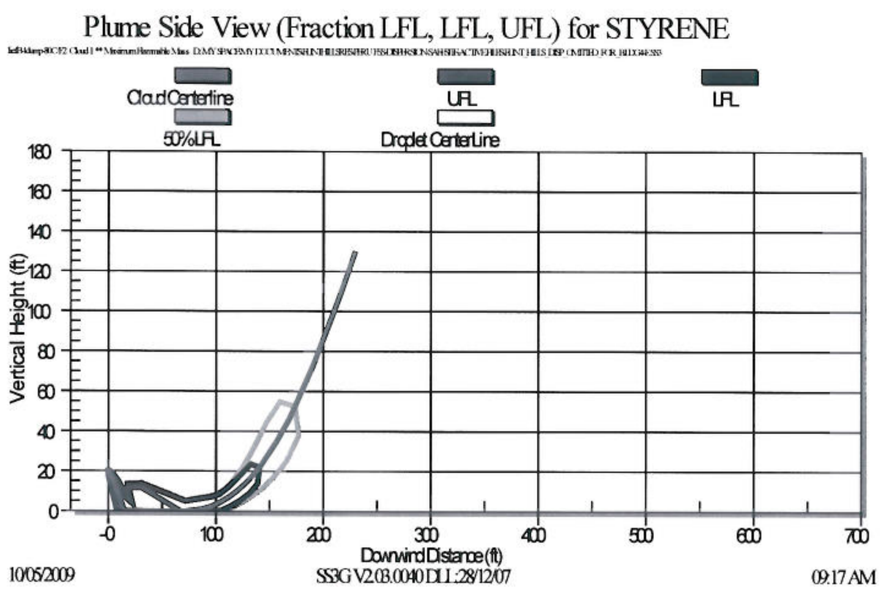

Figure B 1. Plume Side View @ 80 °C

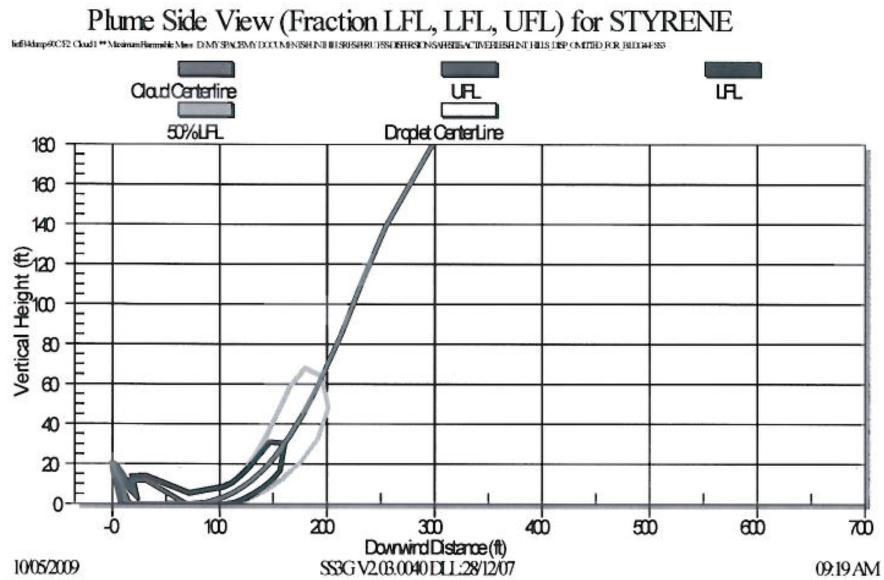

Figure B 2. Plume Side View @90 ºC

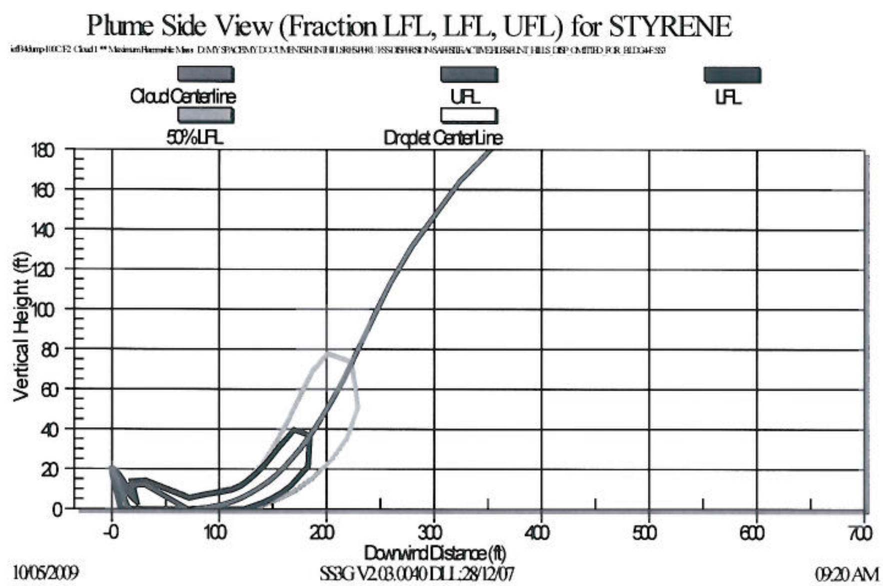

Figure B 3. Plume Side View @100 ºC

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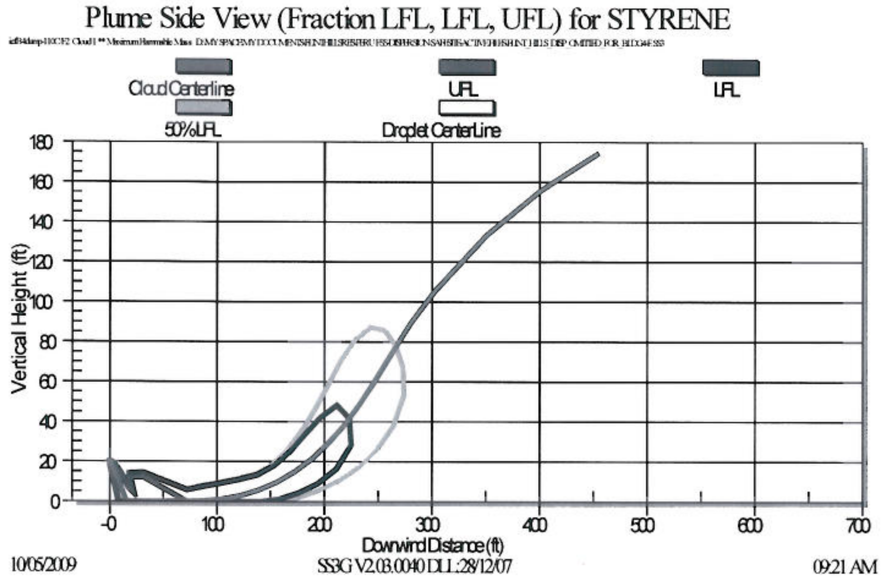

Figure B 4. Plume Side View @110 ºC

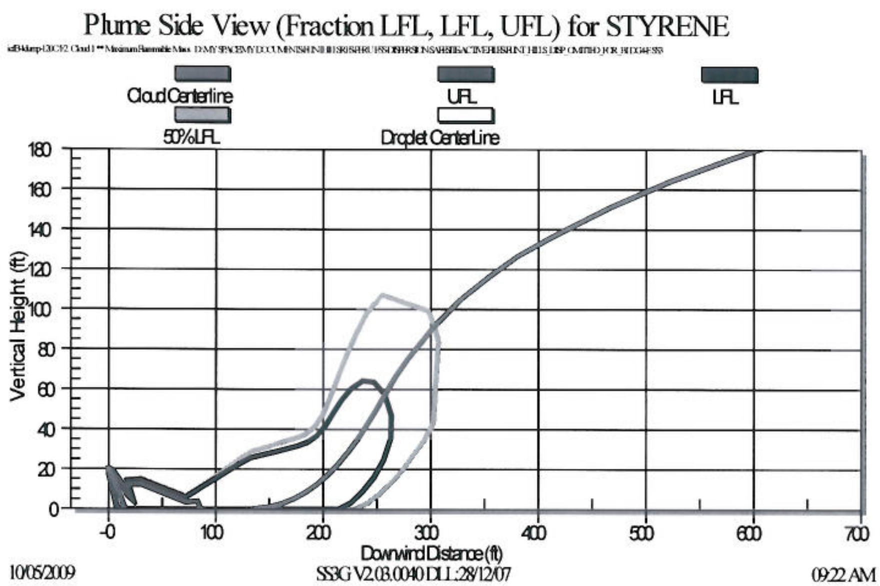

Figure B 5. Plume Side View @120 ºC

FHRPRU001746

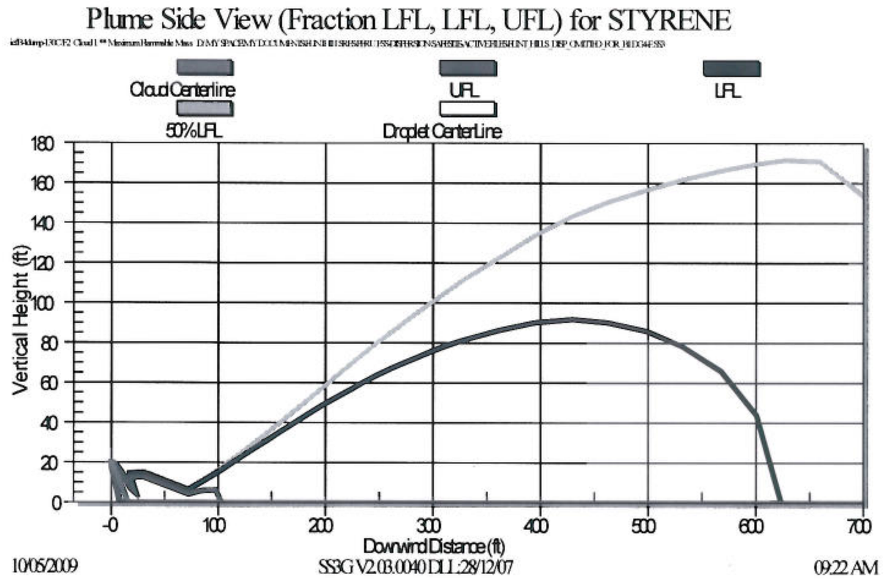

Figure B 6. Plume Side View @130 ºC

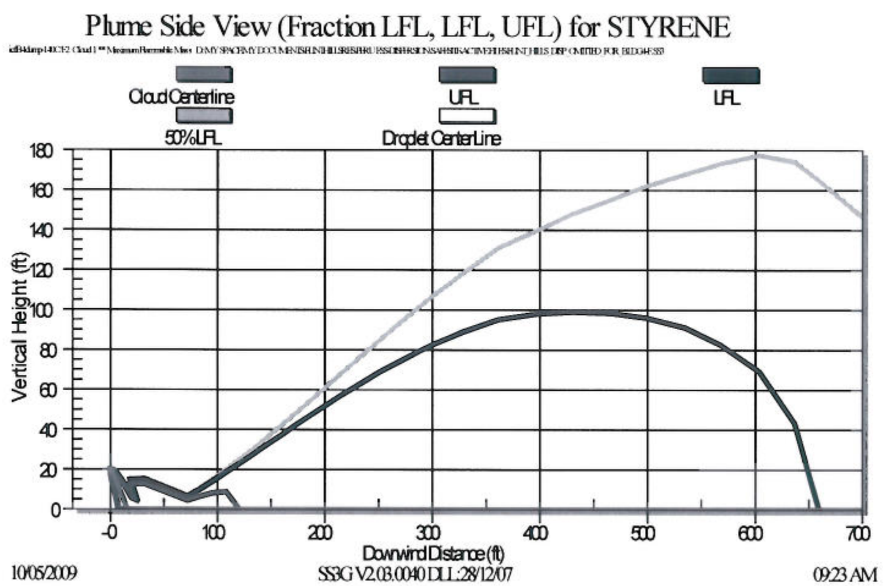

Figure B 7. Plume Side View @140 ºC

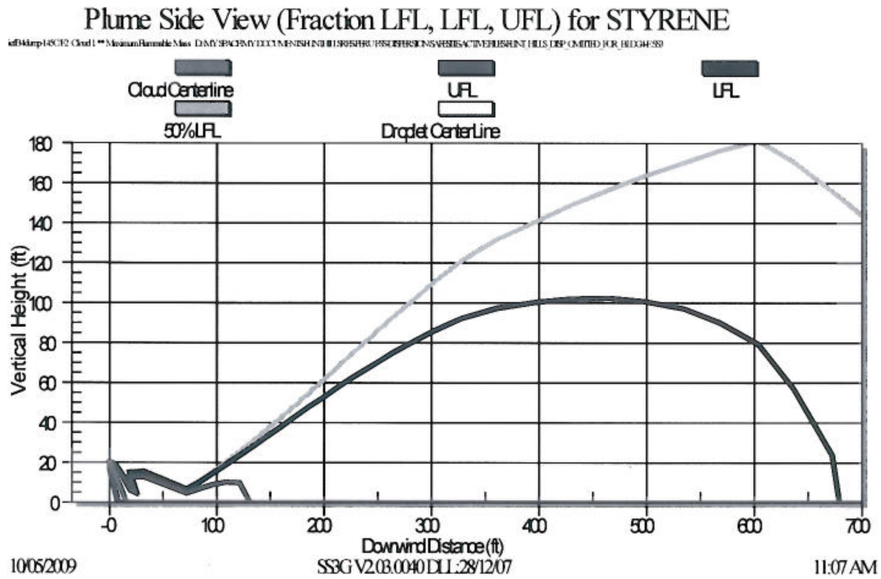

Figure B 8. Plume Side View @145 ºC

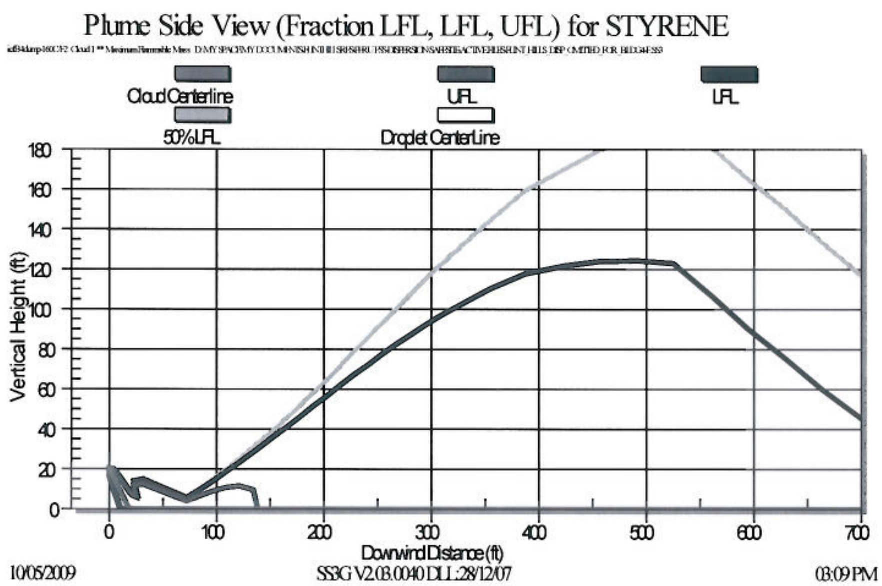

Figure B 9. Plume Side View @160 ºC

APPENDIX C.
BLAST STRENGTH CONTOURS, BY INDIVIDUAL SCENARIO

The Blast Contour plots in this Appendix show the side-on overpressures should the cloud ignite. In some cases the contours are a composite of multiple versions of the same event, and any single event would not cause the contours depicted. This is seen most notably in the plot of Event P-04-TransferB4, which is a plot of 220 different combinations of release location, wind direction and atmospheric stability along the route from storage to the process areas.

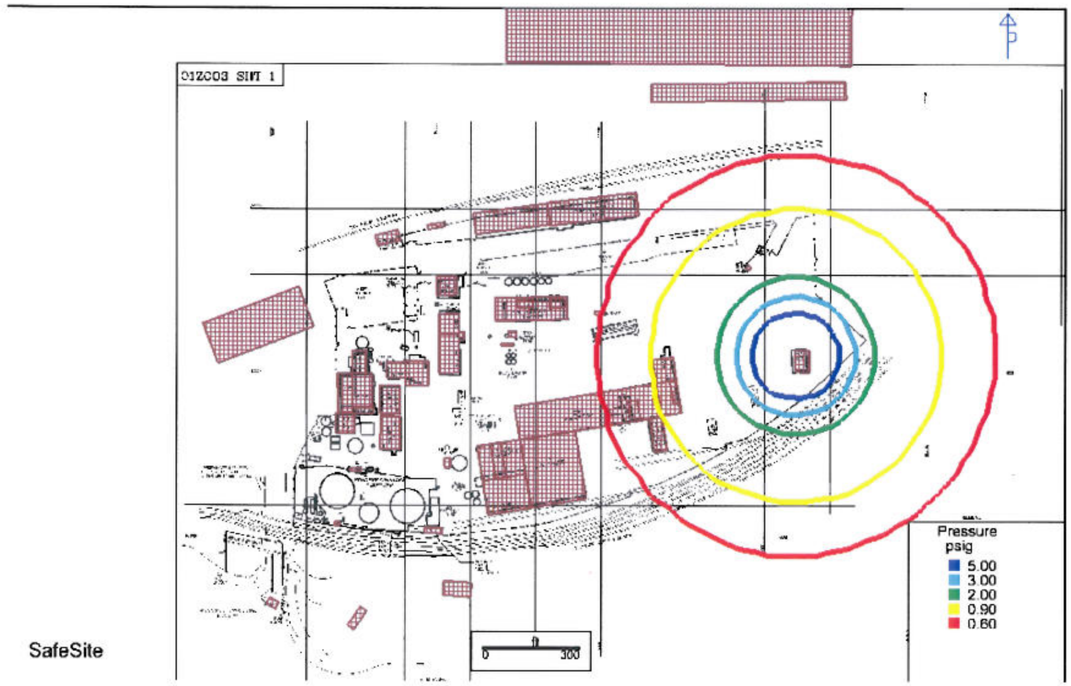

Figure C 1: (di) benzoyl peroxide storage - Pressure Contours

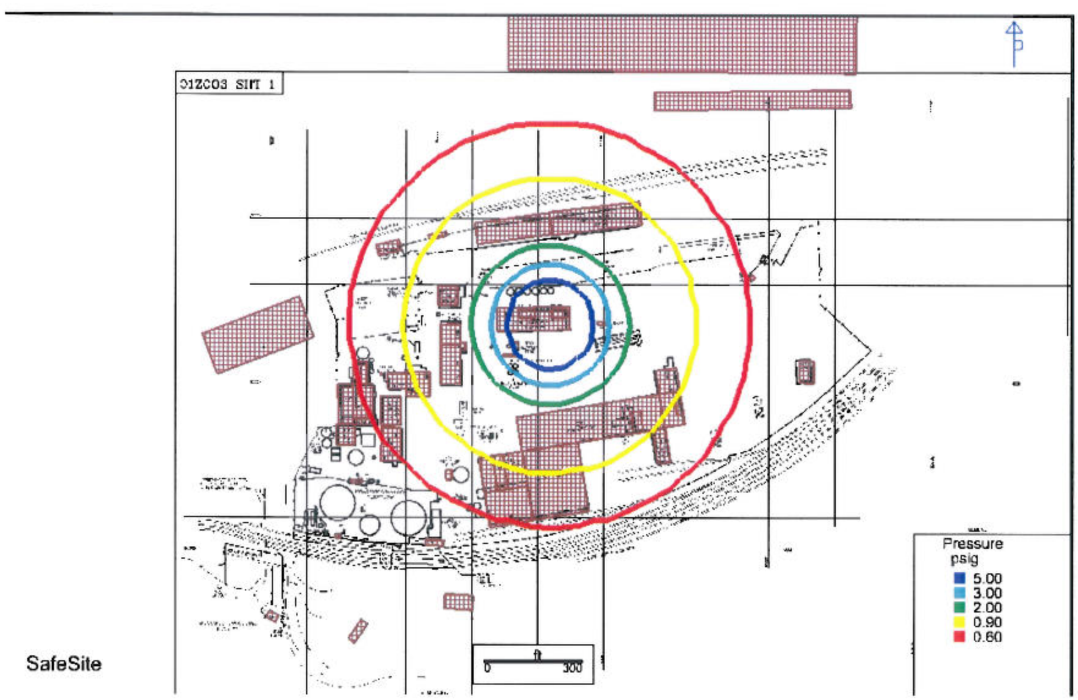

Figure C 2: (di) benzoyl peroxide (Bldg 4) - Pressure Contours

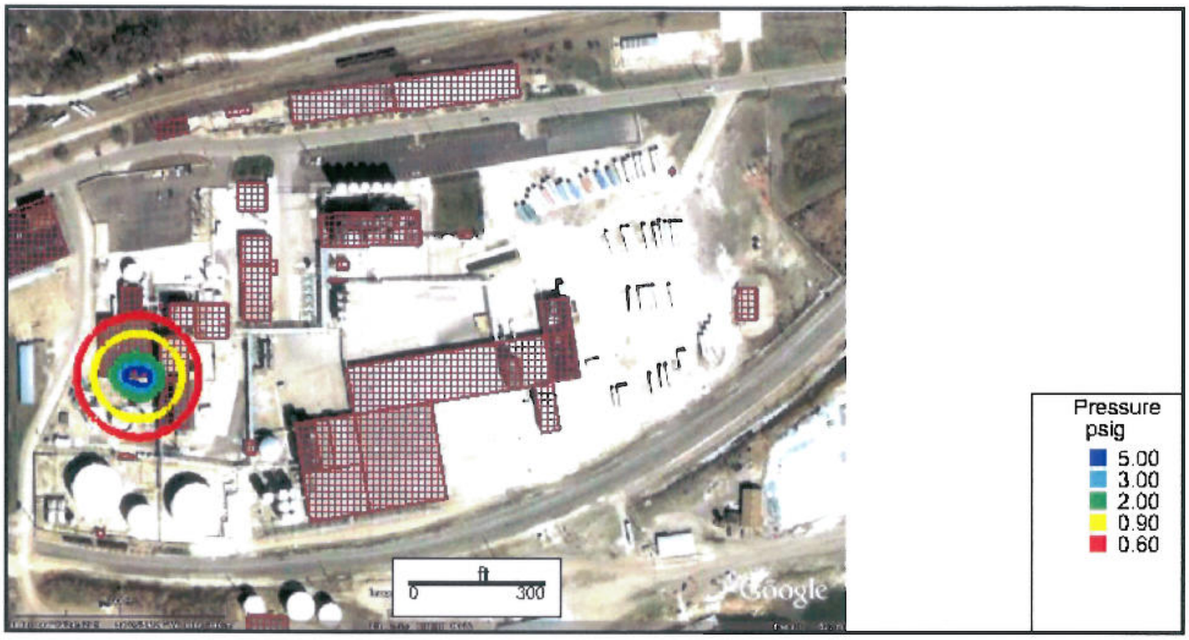

Figure C 3: S-06-PilotPlant - Pressure Contours

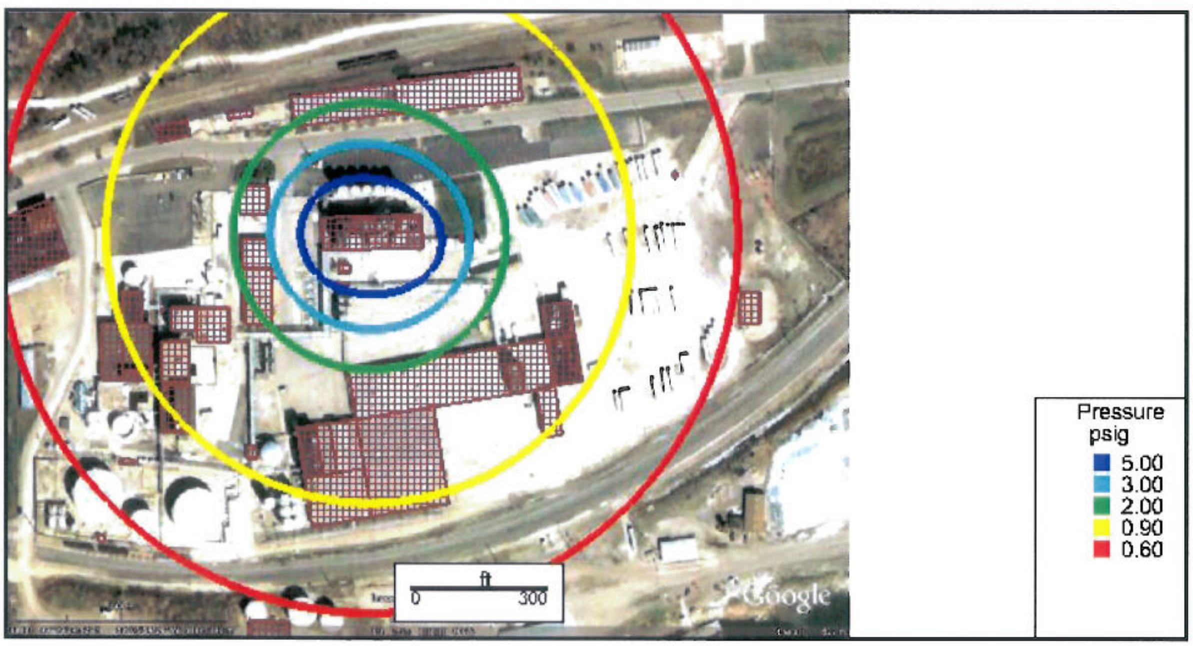

Figure C 4: P-06-Bldg4 - Pressure Contours

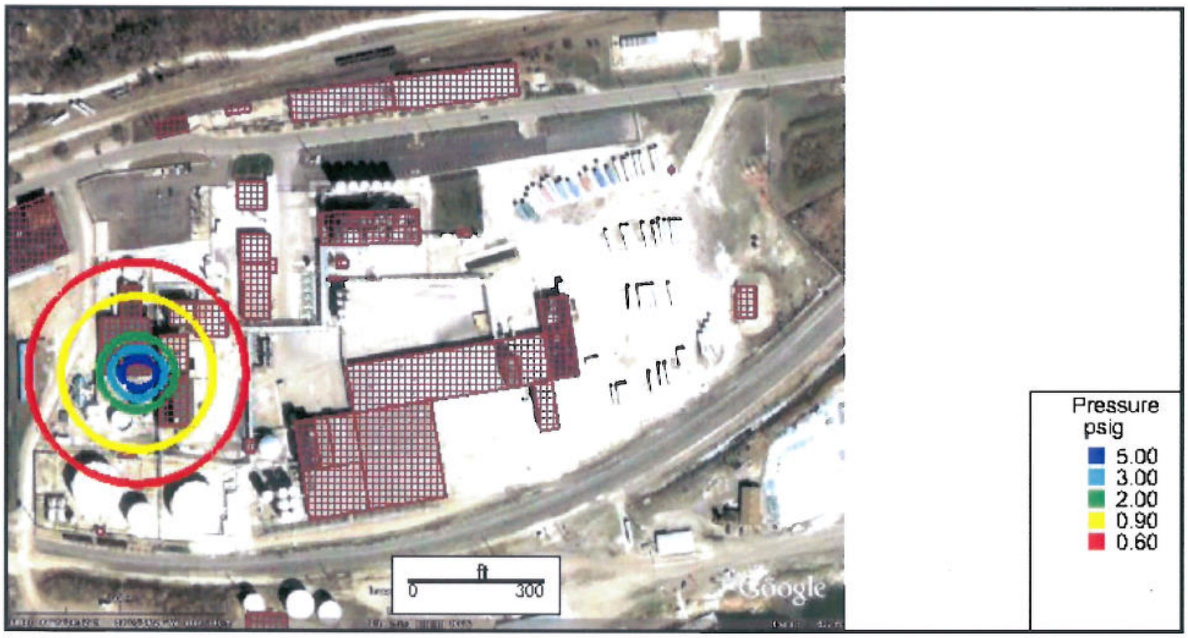

Figure C 5: P-05-PilotPlant - Pressure Contours

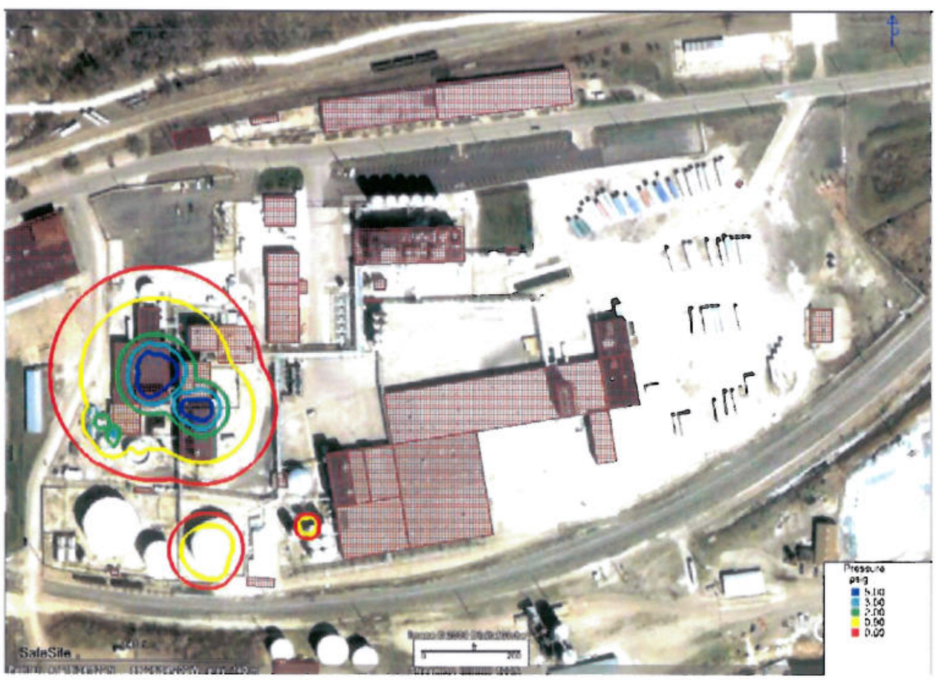

Figure C 6: S-03-Storage - Pressure Contours

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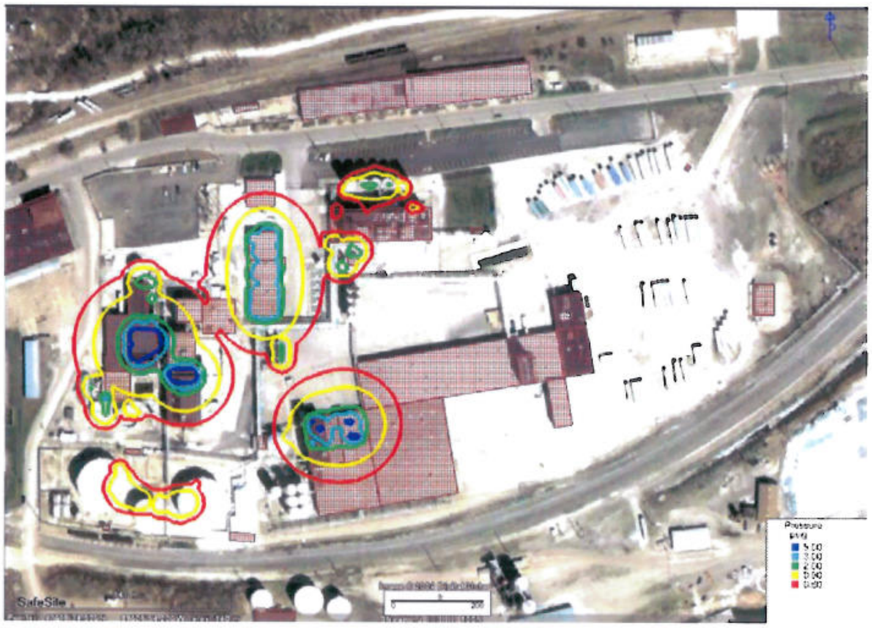

Figure C 7: P-04-TransferB4 - Pressure Contours

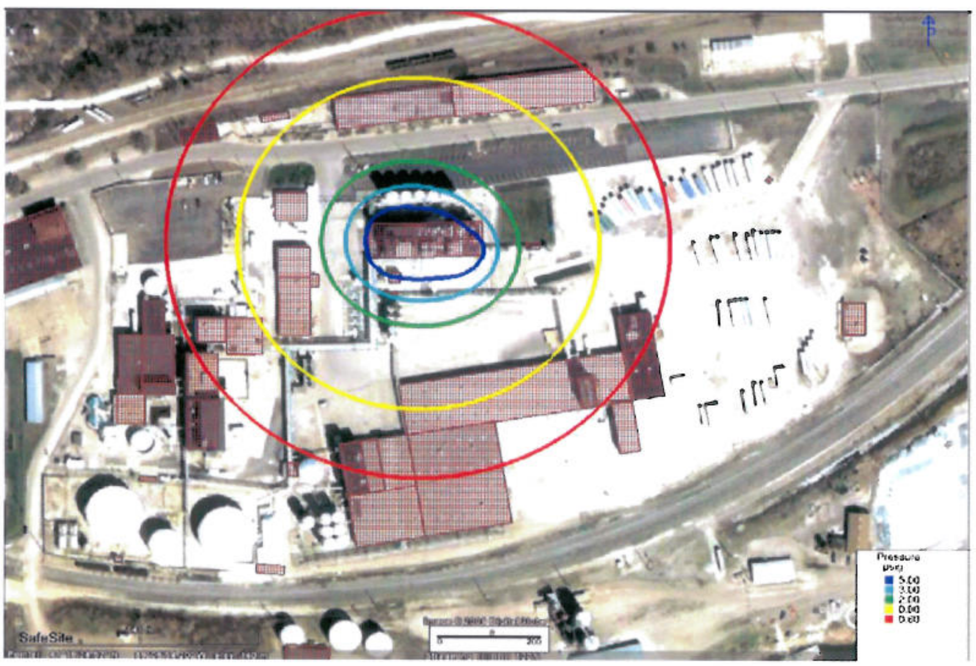

Figure C 8: S-07 - Pressure Contours

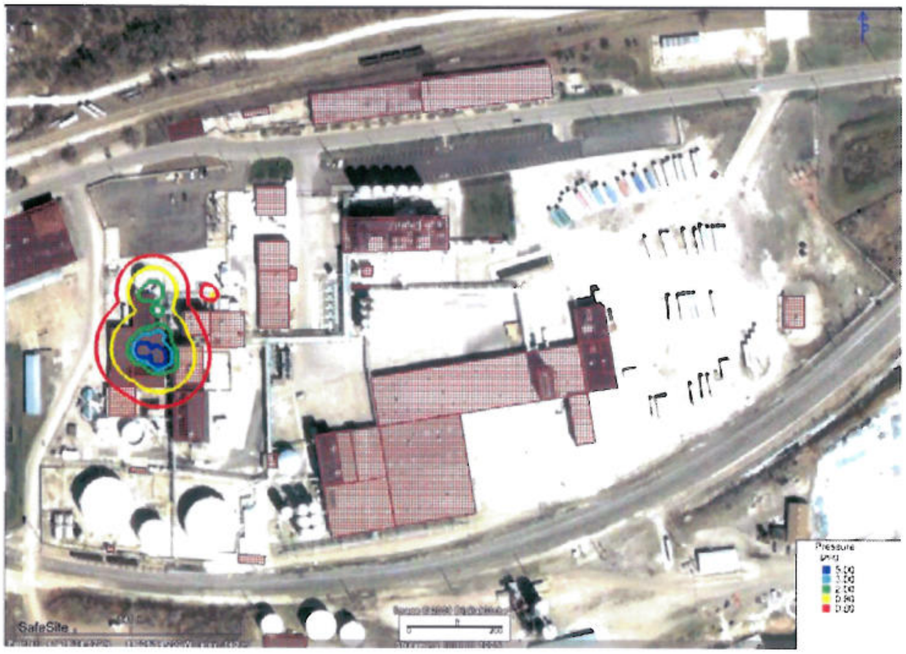

Figure C 9: PR-01-Propane Hose Rupture - Pressure Contours

APPENDIX D.
CONTROLLING BLAST LOADS

Note that in contrast to the blast contours presented earlier, the loads presented in this table are *reflected* loads, and so take into account the actual net forces to which the buildings will be subjected.

Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
Administration Building:1 story warehouse	Roof	P-06-Bldg4	1.97	65
Administration Building:1 story warehouse	Side 1 (South)	P-06-Bldg4	4.58	146
Administration Building:1 story warehouse	Side 2 (East)	P-06-Bldg4	1.84	61
Administration Building:1 story warehouse	Side 3 (North)	P-06-Bldg4	1.75	58
Administration Building:1 story warehouse	Side 4 (West)	P-06-Bldg4	1.80	59
Bead Recovery Building	Roof	P-06-Bldg4	6.93	200
Bead Recovery Building	Side 1 (East)	P-06-Bldg4	11.04	331
Bead Recovery Building	Side 2 (North)	P-06-Bldg4	15.66	438
Bead Recovery Building	Side 3 (West)	P-06-Bldg4	6.56	202
Bead Recovery Building	Side 4 (South)	P-06-Bldg4	6.02	176
Boiler Room	Roof	P-06-Bldg4	1.41	49
Boiler Room	Side 1 (South)	P-06-Bldg4	1.33	46
Boiler Room	Side 2 (East)	P-06-Bldg4	3.13	106
Boiler Room	Side 3 (North)	P-06-Bldg4	3.00	102
Boiler Room	Side 4 (West)	P-06-Bldg4	1.29	45
Building 1	Roof	P-06-Bldg4	1.22	43
Building 1	Side 1 (South)	P-06-Bldg4	1.18	42
Building 1	Side 2 (East)	P-06-Bldg4	2.64	92
Building 1	Side 3 (North)	P-06-Bldg4	2.53	88
Building 1	Side 4 (West)	P-06-Bldg4	1.14	41
Catalyst Building	Roof	(di) benzoyl peroxide storage	*	*
Catalyst Building	Side 1 (East)	(di) benzoyl peroxide storage	*	*
Catalyst Building	Side 2 (North)	(di) benzoyl peroxide storage	*	*
Catalyst Building	Side 3 (West)	(di) benzoyl peroxide storage	*	*
Catalyst Building	Side 4 (South)	(di) benzoyl peroxide storage	*	*
Chips:Pelletizing Area 1st Fl	Roof	P-06-Bldg4	1.05	39
Chips:Pelletizing Area 1st Fl	Side 1 (South)	P-06-Bldg4	0.97	36
Chips:Pelletizing Area 1st Fl	Side 2 (East)	P-06-Bldg4	0.99	37

Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
Chips:Pelletizing Area 1st Fl	Side 3 (North)	P-06-Bldg4	2.29	83
Chips:Pelletizing Area 1st Fl	Side 4 (West)	P-06-Bldg4	2.24	81
Chips:Pelletizing area 2nd Fl	Roof	P-06-Bldg4	1.04	38
Chips:Pelletizing area 2nd Fl	Side 1 (South)	P-06-Bldg4	0.98	36
Chips:Pelletizing area 2nd Fl	Side 2 (East)	P-06-Bldg4	1.02	38
Chips:Pelletizing area 2nd Fl	Side 3 (North)	P-06-Bldg4	2.20	80
Chips:Pelletizing area 2nd Fl	Side 4 (West)	P-06-Bldg4	2.12	78
Chips:Polymerization	Roof	P-06-Bldg4	1.20	43
Chips:Polymerization	Side 1 (South)	P-06-Bldg4	1.13	41
Chips:Polymerization	Side 2 (East)	P-06-Bldg4	1.12	41
Chips:Polymerization	Side 3 (North)	P-06-Bldg4	2.53	90
Chips:Polymerization	Side 4 (West)	P-06-Bldg4	2.59	92
Contractor's trailer 1	Roof	P-06-Bldg4	1.44	49
Contractor's trailer 1	Side 1 (South)	P-06-Bldg4	2.97	100
Contractor's trailer 1	Side 2 (East)	P-06-Bldg4	3.06	103
Contractor's trailer 1	Side 3 (North)	P-06-Bldg4	1.41	48
Contractor's trailer 1	Side 4 (West)	P-06-Bldg4	1.37	47
Diesel / Diesel Oil Buildings	Roof	P-06-Bldg4	5.00	150
Diesel / Diesel Oil Buildings	Side 1 (South)	P-06-Bldg4	4.80	144
Diesel / Diesel Oil Buildings	Side 2 (East)	P-06-Bldg4	8.62	268
Diesel / Diesel Oil Buildings	Side 3 (North)	P-06-Bldg4	10.36	307
Diesel / Diesel Oil Buildings	Side 4 (West)	P-06-Bldg4	4.57	138
East Guardhouse	Roof	(di) benzoyl peroxide storage	1.46	23
East Guardhouse	Side 1 (East)	(di) benzoyl peroxide storage	3.04	48
East Guardhouse	Side 2 (North)	(di) benzoyl peroxide storage	1.46	23
East Guardhouse	Side 3 (West)	(di) benzoyl peroxide storage	1.41	22
East Guardhouse	Side 4 (South)	(di) benzoyl peroxide storage	3.04	48
EPS - Building 4:Main building	Roof	P-06-Bldg4	*	*
EPS - Building 4:Main building	Roof	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Main building	Side 1 (South)	(di) benzoyl peroxide (Bldg 4)	*	*

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Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
EPS - Building 4:Main building	Side 2 (East)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Main building	Side 3 (North)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Main building	Side 4 (West)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Main building	Side 4 (West)	P-06-Bldg4	*	*
EPS - Building 4:Motor Control Room	Roof	P-06-Bldg4	*	*
EPS - Building 4:Motor Control Room	Roof	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Motor Control Room	Side 1 (South)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Motor Control Room	Side 1 (South)	P-06-Bldg4	*	*
EPS - Building 4:Motor Control Room	Side 2 (East)	P-06-Bldg4	*	*
EPS - Building 4:Motor Control Room	Side 2 (East)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Motor Control Room	Side 3 (North)	P-06-Bldg4	*	*
EPS - Building 4:Motor Control Room	Side 3 (North)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Motor Control Room	Side 4 (West)	P-06-Bldg4	*	*
EPS - Building 4:Motor Control Room	Side 4 (West)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Reactor Control Room	Roof	P-06-Bldg4	*	*
EPS - Building 4:Reactor Control Room	Side 1 (South)	P-06-Bldg4	*	*
EPS - Building 4:Reactor Control Room	Side 2 (East)	(di) benzoyl peroxide (Bldg 4)	*	*
EPS - Building 4:Reactor Control Room	Side 2 (East)	P-06-Bldg4	*	*
EPS - Building 4:Reactor Control Room	Side 3 (North)	P-06-Bldg4	*	*
EPS - Building 4:Reactor Control Room	Side 4 (West)	P-06-Bldg4	*	*
Flare Building	Roof	P-06-Bldg4	2.99	98
Flare Building	Roof	(di) benzoyl peroxide (Bldg 4)	3.41	41
Flare Building	Side 1 (South)	P-06-Bldg4	3.39	114
Flare Building	Side 2 (East)	(di) benzoyl peroxide (Bldg 4)	2.96	38
Flare Building	Side 2 (East)	P-06-Bldg4	2.75	91
Flare Building	Side 3 (North)	P-06-Bldg4	3.32	117
Flare Building	Side 4 (West)	(di) benzoyl peroxide (Bldg 4)	8.12	95
Flare Building	Side 4 (West)	P-06-Bldg4	6.55	213

Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
Locker Room Building	Roof	P-06-Bldg4	2.31	74
Locker Room Building	Side 1 (South)	P-06-Bldg4	4.28	144
Locker Room Building	Side 2 (East)	P-06-Bldg4	5.45	168
Locker Room Building	Side 3 (North)	P-06-Bldg4	2.19	70
Locker Room Building	Side 4 (West)	P-06-Bldg4	2.01	65
Maintenance Building:1 story section	Roof	P-06-Bldg4	2.12	69
Maintenance Building:1 story section	Roof	P-04-TransferB4_7	4.07	53
Maintenance Building:1 story section	Roof	P-04-TransferB4_5	4.11	51
Maintenance Building:1 story section	Side 1 (South)	P-04-TransferB4_7	3.44	47
Maintenance Building:1 story section	Side 1 (South)	P-06-Bldg4	1.85	62
Maintenance Building:1 story section	Side 1 (South)	P-04-TransferB4_7	3.59	46
Maintenance Building:1 story section	Side 2 (East)	P-06-Bldg4	4.85	156
Maintenance Building:1 story section	Side 3 (North)	P-06-Bldg4	4.79	153
Maintenance Building:1 story section	Side 3 (North)	P-04-TransferB4_7	5.02	55
Maintenance Building:1 story section	Side 4 (West)	P-06-Bldg4	1.89	63
Maintenance Building:2 story section (N)	Roof	P-06-Bldg4	2.47	79
Maintenance Building:2 story section (N)	Side 1 (South)	P-06-Bldg4	2.36	76
Maintenance Building:2 story section (N)	Side 2 (East)	P-06-Bldg4	5.88	182
Maintenance Building:2 story section (N)	Side 3 (North)	P-06-Bldg4	3.12	100
Maintenance Building:2 story section (N)	Side 4 (West)	P-06-Bldg4	2.13	69
Maintenance Building: Contractors Breakroom	Roof	P-06-Bldg4	2.81	89
Maintenance Building: Contractors Breakroom	Side 1 (South)	P-06-Bldg4	2.71	7.8.1 86
Maintenance Building: Contractors Breakroom	Side 2 (East)	P-06-Bldg4	5.99	186
Maintenance Building: Contractors Breakroom	Side 3 (North)	P-06-Bldg4	5.88	183
Maintenance Building: Contractors Breakroom	Side 4 (West)	P-06-Bldg4	2.68	85
Pilot Plant	Roof	P-05-PilotPlant	8.75	295
Pilot Plant	Side 1 (South)	P-05-PilotPlant	19.26	505
Pilot Plant	Side 2 (East)	P-05-PilotPlant	6.67	263

Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
Pilot Plant	Side 3 (North)	S-03-Storage	8.91	111
Pilot Plant	Side 3 (North)	P-05-PilotPlant	7.64	197
Pilot Plant	Side 4 (West)	P-05-PilotPlant	5.76	142
Poly Building 2	Roof	P-05-PilotPlant	1.89	58
Poly Building 2	Side 1 (South)	S-03-Storage	10.75	73
Poly Building 2	Side 2 (East)	P-06-Bldg4	2.25	80
Poly Building 2	Side 3 (North)	P-06-Bldg4	2.24	80
Poly Building 2	Side 4 (West)	P-05-PilotPlant	5.40	162
Poly Building 2	Side 4 (West)	S-03-Storage	6.40	128
Poly Building 3	Roof	P-05-PilotPlant	1.57	46
Poly Building 3	Side 1 (East)	P-06-Bldg4	2.00	73
Poly Building 3	Side 2 (North)	S-03-Storage	5.60	58
Poly Building 3	Side 2 (North)	P-05-PilotPlant	3.89	116
Poly Building 3	Side 3 (West)	P-05-PilotPlant	4.64	123
Poly Building 3	Side 4 (South)	P-05-PilotPlant	1.29	38
Propane Tank Fill House	Roof	S-03-Storage	1.41	23
Propane Tank Fill House	Roof	P-06-Bldg4	1.11	40
Propane Tank Fill House	Side 1 (South)	S-03-Storage	3.03	49
Propane Tank Fill House	Side 1 (South)	P-05-PilotPlant	2.06	61
Propane Tank Fill House	Side 2 (East)	P-06-Bldg4	2.25	80
Propane Tank Fill House	Side 3 (North)	P-06-Bldg4	2.25	80
Propane Tank Fill House	Side 4 (West)	S-03-Storage	2.95	41
Propane Tank Fill House	Side 4 (West)	P-05-PilotPlant	2.02	60
Refrigeration House	Roof	P-05-PilotPlant	0.87	26
Refrigeration House	Side 1 (East)	P-05-PilotPlant	1.35	43
Refrigeration House	Side 2 (North)	P-05-PilotPlant	1.95	56
Refrigeration House	Side 3 (West)	P-05-PilotPlant	0.86	26
Refrigeration House	Side 4 (South)	P-05-PilotPlant	0.79	23
Storage3 Building 8	Roof	P-06-Bldg4	1.10	39
Storage3 Building 8	Side 1 (South)	P-06-Bldg4	2.28	80
Storage3 Building 8	Side 2 (East)	P-06-Bldg4	2.37	83
Storage3 Building 8	Side 3 (North)	P-06-Bldg4	1.07	38

Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
Storage3 Building 8	Side 4 (West)	P-06-Bldg4	1.03	37
TD Lab Building	Roof	P-05-PilotPlant	2.09	56
TD Lab Building	Roof	S-03-Storage	2.55	32
TD Lab Building	Side 1 (South)	P-05-PilotPlant	3.16	84
TD Lab Building	Side 2 (East)	P-05-PilotPlant	4.93	131
TD Lab Building	Side 2 (East)	S-03-Storage	9.54	100
TD Lab Building	Side 3 (North)	P-06-Bldg4	1.74	64
TD Lab Building	Side 3 (North)	S-03-Storage	1.80	27
TD Lab Building	Side 4 (West)	S-03-Storage	1.84	25
TD Lab Building	Side 4 (West)	P-05-PilotPlant	1.68	46
Warehouse adjacent to TD Lab	Roof	S-03-Storage	6.01	66
Warehouse adjacent to TD Lab	Roof	P-05-PilotPlant	2.43	66
Warehouse adjacent to TD Lab	Side 1 (South)	P-05-PilotPlant	13.68	315
Warehouse adjacent to TD Lab	Side 2 (East)	S-03-Storage	11.40	113
Warehouse adjacent to TD Lab	Side 3 (North)	S-03-Storage	2.73	44
Warehouse adjacent to TD Lab	Side 3 (North)	P-06-Bldg4	1.93	70
Warehouse adjacent to TD Lab	Side 4 (West)	P-05-PilotPlant	2.14	58
Warehouse adjacent to TD Lab	Side 4 (West)	S-03-Storage	4.66	49
Wastewater Treatment Building	Roof	P-05-PilotPlant	2.64	68
Wastewater Treatment Building	Side 1 (South)	S-03-Storage	1.53	62
Wastewater Treatment Building	Side 1 (South)	P-05-PilotPlant	1.91	51
Wastewater Treatment Building	Side 2 (East)	P-05-PilotPlant	7.28	174
Wastewater Treatment Building	Side 3 (North)	P-05-PilotPlant	3.95	116
Wastewater Treatment Building	Side 4 (West)	S-03-Storage	2.99	139
Wastewater Treatment Building	Side 4 (West)	S-03-Storage	2.98	140
Water Treatment Building	Roof	P-06-Bldg4	0.97	35
Water Treatment Building	Roof	S-03-Storage	1.51	24
Water Treatment Building	Roof	P-05-PilotPlant	1.04	30
Water Treatment Building	Side 1 (South)	S-03-Storage	5.70	93
Water Treatment Building	Side 2 (East)	P-06-Bldg4	2.04	73
Water Treatment Building	Side 3 (North)	P-06-Bldg4	1.99	72
Water Treatment Building	Side 4 (West)	P-05-PilotPlant	1.01	30

Building	Side	Scenario	Pressure (psig)	Impulse (psig-ms)
Water Treatment Building	Side 4 (West)	P-06-Bldg4	0.93	34
Water Treatment Building	Side 4 (West)	S-03-Storage	1.45	23

APPENDIX E.
TESTS OF ALTERNATIVE BUILDING 4 REACTOR DUMP CONCEPTS

The site currently considers initiating a Building 4 reactor dump if the temperature varies more than 4 °F from the batch temperature specification, and a dump is initiated automatically if the temperature reaches 210 °F. The specific conditions in the reactor at the time of a dump are described below and are referenced as Scenario R-03 in this study.

Special Note Regarding Scenario R-03

The current practice for performing a low pressure dump from a Building 4 reactor follows:

- Catalyst has been added.
- Reactor is vented to flare prior to initiation of dump (reactor pressure is less than 2 psig).
- When preparing to dump, the vent to flare is shut and the reactor is sealed up (at 200 °F)
- Dump is started when the reactor reaches 205 °F, vs. the normal reaction hold temperature of 91.5 °C (196.7 °F) during the reaction phase. At this point, approximately 57% of the styrene has already reacted.
- Agitation in the reactor is maintained, and nitrogen is opened up to the reactor with a set point of 20 psig. Mostly this is used to counter the vacuum effect of dumping from a closed up vessel. Due to the small line size for the nitrogen there is typically not much pressure built up (~5 psi). If the dump to pit gets plugged then the pressure in the reactor would start to build but since this is at the beginning of the reaction there shouldn't be anything to restrict the dump.
- It takes approximately 20 minutes to empty the reactor.

Under typical summer conditions, the release discharge and pit will cause the contents of the pit to cool to about 181 °F initially. However the polymerization reaction continues (at a reduced rate), and the contents of the pit self-heat at about 1 °F per minute, offsetting additional cooling by the pit walls. To replicate the self-heating effect (both inside the reactor and outside), the release was modeled as occurring at 215 °F. Beyond this temperature it is assumed that the water that will settle to the bottom of the pit will moderate the pool temperature by boiling away. A calculation confirmed that there is more water in the discharge to the pit than the available energy of reaction to boil it completely away.

However, other options exist. The site wished to know whether the current practice was the optimal one, with respect to the ultimate disposition of styrene/vapor that would be released upon discharge to the dump pit. For this reason, a series of modeling runs was performed in which the reactor contents were released at different temperatures. For the purposes of these calculations it was assumed that the reaction in the pit was negligible, and that the rate of vaporization from the pool was simply a function of the pool temperature as it developed from the release of non-agitated reactor contents into the pool, and unrelated to heat/vapors generated as a result of reactions in the pit. The results of these runs are presented in Appendix B.

Alternatives for the mixed dump condition are described next.

Alternatives

The site has questioned whether this approach is optimal with respect to the balance between safety and environmental discharge that results when a dump occurs. A series of modeling runs was conducted to test various alternatives suggested by the site. The results of these runs follow.

ALTERNATIVE 1: **REVIEW OF IN SITU CONTAINMENT OF OFF-SPEC POLYSTYRENE BATCH**

Following is a review of different versions of *in situ* containment of polystyrene batches that have gone off-spec. The following scenarios are considered:

- Scenario 1 – Atmospheric Vent Closed at 200 °F, Mixing Continued
- Scenario 2 – to be developed
- Scenario 3 – to be developed

Approach

A spreadsheet was developed to document and calculate various process parameters step-wise in time. Some of the entries on this spreadsheet were calculated and others were initial conditions or physical constants estimated using DIPPR algorithms from SafeSite$_{3G}$®. Some of the calculations performed are described below and can be compared to the spreadsheet calculations provided separately as an MS Excel file.

- **d(S/So')/dt (fractional rate of styrene conversion)** – This was taken from a separate reaction kinetics spreadsheet which has been previously validated against the reaction half-lives. For each point in time, the maximum (initial) rate at a given temperature was used since the temperatures were changing during the model run.
- **Fraction of reaction completed** – For each time step, this fraction is calculated as the sum of the completion at the previous step, plus the reaction completed during the time step. The latter was calculated as the average reaction rate during the time step multiplied by the time interval.
- **dS/dt (rate of styrene conversion)** – Equal to the fractional rate of conversion d(S/So'/dt) multiplied by the concentration So' of the styrene at the time of the step. So' is equal to the initial concentration So multiplied by the fraction of the reaction yet to be completed.

- **Heat of reaction** – This value, calculated in units of Joules/second, is calculated as the rate of styrene conversion (mol/liter-sec) × volume in liquid phase (liters) × heat of reaction (J/mol).
- **Self-heat rate** – Calculated as the heat of reaction (J/sec) divided by the heat capacity of the liquid phase (J/kg-degK) divided by the density of the mixture (kg/liter) divided by the volume of the liquid phase (liters). After conversion of temperature units, this is reported in °F/second.
- **Volume of vapor generated** – Initially the heat of reaction is assumed to be completely absorbed by self-heating the mixture. Eventually the mixture reaches its boiling point and vapor is produced. Based on the vapor pressures of water and styrene at 212 °F, a general assumption is made that this same ratio is the ratio in the produced vapor. For that reason, the density and heat of vaporization for an 80:20 water/styrene mixture is used for this calculation, which is: Heat of reaction (J/sec) divided by heat of vaporization (J/kg) divided by vapor density (lb/gal), which after conversion from pounds to kilograms is reported in units of gallons/second of vapor. This rate of vapor production during the step interval (seconds) is compared to the initial vapor space volume to determine the pressure increase in the system during the time interval. The mass flow rate of vapor is calculated in a similar manner, but not having to account for the vapor density.

The analysis of the individual scenarios follows.

Scenario 1 – Atmospheric Vent Closed at 200 °F, Mixing Continued
In this case, the plant terminates the batch at 200 °Fahrenheit but contains the mixture in the reactor. Mixing continues. Table E-1 illustrates how the temperature and pressure in the system increase with time. There are a number of assumptions in this analysis, including:

1. There is no net change in the liquid phase volume (which is important because of its potential to compress or expand the vapor phase and thus the system pressure). In fact, the liquid will expand with increasing temperature, but the production of polystyrene is known to reduce the volume in a styrene/polystyrene system. As it happens, this was checked at one point (212 °F), and the amount of thermal expansion was virtually the same as the predicted shrinkage due to polymerization – that is, no overall net change in liquid phase volume.

2. As long as the batch has not reached its boiling point, it is assumed that the entire heat of reaction is absorbed as a temperature rise in the liquid phase, and none of it is used to create new free vapor. That is, prior to boiling, the pressure in the system increases only because of increases in the vapor pressure above the liquid phase and, to a much lesser extent, ideal gas expansion of the non-condensibles present in the vapor at the time the atmospheric vent is closed. The pressure could also change significantly based on expansion or contraction of the liquid space, but since the expansion and contraction phenomena appear to cancel each other out, there is no net influence of liquid volume change in the system pressure.

Of particular note is the fact that as long as the mixture is kept below its boiling point, there does not appear to be a concern. However, once boiling begins, the pressure rapidly increases (boiling is assumed to start at 225 °F, since the precise boiling point of this system at elevated pressures is not known). Once the batch vapors burst the rupture disk, the system will depressure again and slowly start to rebuild pressure as the batch temperature (and vapor generation) increases.

At some point the reaction proceeds so vigorously that vapors are generated faster than they can be relieved through the rupture disk. Based on some very rough calculations (which should be verified by the RD calculation sheet), the RD should relieve about 10,000 lb/min of pure vapor.

Conclusions – Based on the draft version calculations, there will not be a significant pressure buildup until the styrene/water mixture reaches its boiling point, very roughly projected to occur after about 5 minutes from the time the vent line is closed, at a temperature of roughly 225 °F. Once boiling begins, the pressure rapidly increases to the rupture disk opening pressure of 150 psig, after which the pressure drops again since the system pressure relieves faster than new vapor is being generated. Eventually, however, the reaction rate is vigorous enough that it is projected to exceed the rupture disk relief capacity. This occurs at about 270 °F, about 7 to 8 minutes after the vent line is closed.

This analysis depends on a number of assumptions, and does not yet account for the potential carryover of liquid phase into the relief piping. This "champagne effect" could constrict the vapor relief flow path, thus reducing the effective relief rate by an as yet-to-be-determined amount.

Table E 1. Temperature/Pressure Profile for Reactor When Blocked in at 200 °F, with Mixing

FOR MIXED PHASE REACTION, ASSUMING REACTION CONTINUES ACCORDING TO NORMAL KINETICS. REACTOR VENT BLOCKED IN AT 200 F.

Heat of polymerization	6.00E+04 J/mole styrene		(not per mole of polystyrene?)
Initial volume of styrene	7495 gal	28368.575	liters
Initial volume of water	7072 gal	26767.52	liters
Initial volume of liquid phase	14567 gal	55136.095	liters
Initial volume of vapor phase	1440 gal		
Initial concentration of styrene	4.133 mol/liter		

Assumes: Minor amount of reaction has been completed at t = 0 seconds
Water boils at 212 at 14.7 psig, but not until 225F at elevated pressure.

Time after vent block-in (sec)	Temp (F)	d(S/So)/dt max (1/sec)	Fraction of Rxn done	dS/dt (mol/liter-sec)	Heat of Rxn (J/sec)	Density of 50:50 mix (kg/liter)	Heat capacity of 50:50 mix (J/kg-degK)	Self-Heat Rate (deg F/sec)	Heat of Vapori-zation of 80:20 mix (J/kg)	Density of 80:20 mix vapor (lb/gal)	Volume of vapor generated (gal/sec at 1 atm.)**	Vapor pressure of 50:50 mix (psia)	Pressure Increase (psi)*	Total Pressure Increase (psi)	System Pressure (psia)	Vapor generated (lb/min)
0	200	0.000252	0.00000	0.00104	3.45E+06	0.8947	3090	0.041	1.162E+06	6.481E-03		10.26			14.7	
25	201	0.000268	0.00639	0.00110	3.64E+06	0.8942	3092	0.043	1.162E+06	6.559E-03		10.47	0.22	0.21	14.9	
48	202	0.000285	0.01282	0.00116	3.85E+06	0.8937	3093	0.045	1.161E+06	6.637E-03		10.69	0.23	0.45	15.2	
70	203	0.000303	0.01928	0.00123	4.06E+06	0.8934	3095	0.048	1.160E+06	6.715E-03		10.91	0.24	0.69	15.4	
91	204	0.000322	0.02580	0.00129	4.28E+06	0.8929	3096	0.051	1.159E+06	6.836E-03		11.13	0.25	0.94	15.6	
110	205	0.000341	0.03235	0.00137	4.52E+06	0.8924	3098	0.053	1.159E+06	6.913E-03		11.36	0.26	1.20	15.9	
129	206	0.000363	0.03895	0.00144	4.76E+06	0.8919	3099	0.056	1.158E+06	6.990E-03		11.59	0.27	1.47	16.2	
147	207	0.000385	0.04559	0.00152	5.02E+06	0.8914	3100	0.059	1.157E+06	7.110E-03		11.83	0.29	1.76	16.5	
164	208	0.000408	0.05228	0.00160	5.29E+06	0.8910	3102	0.063	1.156E+06	7.187E-03		12.07	0.29	2.05	16.8	
180	209	0.000433	0.05901	0.00169	5.58E+06	0.8905	3103	0.066	1.156E+06	7.306E-03		12.31	0.30	2.35	17.1	
195	210	0.000460	0.06579	0.00178	5.87E+06	0.8900	3105	0.069	1.155E+06	7.382E-03		12.56	0.32	2.67	17.4	
209	211	0.000488	0.07262	0.00187	6.18E+06	0.8895	3106	0.073	1.154E+06	7.501E-03		12.81	0.32	2.99	17.7	
223	212	0.000517	0.07949	0.00197	6.51E+06	0.8891	3108	0.077	1.153E+06	7.576E-03		13.07	0.34	3.33	18.0	
236	213	0.000548	0.08642	0.00207	6.85E+06	0.8885	3109	0.081	1.152E+06	7.695E-03		13.33	0.35	3.68	18.4	
248	214	0.000581	0.09340	0.00218	7.21E+06	0.8882	3110	0.085	1.152E+06	7.769E-03		13.60	0.36	4.05	18.7	
260	215	0.000616	0.10043	0.00229	7.58E+06	0.8877	3112	0.090	1.151E+06	7.886E-03		13.87	0.37	4.42	19.1	
310	220	0.000823	0.13652	0.00294	9.71E+06	0.8853	3120	0.115	1.147E+06	8.470E-03		15.28	1.54	5.96	20.7	
347	225	0.001093	0.17183	0.00374	1.24E+07	0.8829	3127	0.146	1.143E+06	9.001E-03	2648	16.81	1.70	7.66	22.4	
375	230	0.001447	0.20689	0.00474	1.57E+07	0.8805	3135	0.186	1.139E+06	9.694E-03	3127	18.47	815.36	823.02	837.7	At this point the rupture disk opens
396	235	0.001908	0.24214	0.00598	1.98E+07	0.8900	3143	0.231	1.135E+06							2304
412	240	0.002504	0.27849	0.00747	2.47E+07	0.8900	3151	0.288	1.131E+06							2889
425	245	0.003275	0.31586	0.00926	3.06E+07	0.8900	3159	0.356	1.126E+06							3599
435	250	0.004266	0.35119	0.01144	3.78E+07	0.8900	3167	0.438	1.122E+06							4461
443	255	0.005535	0.39203	0.01391	4.60E+07	0.8900	3175	0.532	1.118E+06							5444
450	260	0.007155	0.43584	0.01668	5.52E+07	0.8900	3184	0.636	1.114E+06							6554
456	265	0.009214	0.48337	0.01967	6.51E+07	0.8900	3193	0.748	1.109E+06							7763
461	270	0.011822	0.53563	0.02269	7.51E+07	0.8900	3201	0.860	1.105E+06							8985
465	275	0.015110	0.59437	0.02533	8.38E+07	0.8900	3210	0.958	1.100E+06							10077
469	280	0.019240	0.66260	0.02683	8.88E+07	0.8900	3220	1.011	1.096E+06							10712
473	285	0.024405	0.74669	0.02555	8.45E+07	0.8900	3229	0.960	1.091E+06							10248
477	290	0.030838	0.86429	0.01730	5.72E+07	0.8900	3239	0.648	1.087E+06							6963

*Does not account for liquid phase expansion or contraction. By 212F, shrinkage is about 0.6% and liquid expansion is also about 0.6%.

** ***Free*** vapor is assumed to not be generated until 225F. After 225F, generated vapor is assumed to be added into the existing vapor space to increase the pressure.

FOR INITIAL DISCUSSION PURPOSES ONLY, TO CHECK ASSUMPTIONS. CALCULATIONS NOT YET VERIFIED.

APPENDIX F.
BASIS FOR PEROXIDE EXPLOSION MASS INPUTS

As part of the original project, a protocol for converting the energy in a given inventory of benzoyl peroxide (BPO) into an equivalent explosion strength was established. However, there are still outstanding questions as to how to determine the inventory to assume, for the purposes of explosion modeling. The issues are:

1. ***Is the BPO used by the site (75% + 25% water) considered explosive, and under what circumstances?***
2. ***If the BPO is potentially explosive, how much of a given inventory would actually participate in a discrete explosion event (one that occurs on a milliseconds time scale)?***

To try to answer these questions, various standards were reviewed. In addition, the input from two subject matter experts was obtained, one of whom is on the relevant NFPA committee and the other a peroxide supplier to the Peru site. Other people were solicited but either they did not have meaningful information to provide and/or they were unwilling to provide the information. By far the most helpful person was Tomas Salvador at Arkema.

Note that the information that follows is a synopsis of various sources of information, both written and verbal. Because there is a possibility of misunderstanding/misinterpretation, the original sources of information should be consulted prior to instituting measures based on this document.

Question 1 – Is the BPO Used at Peru Explosive?

When handled as specified, the BPO used by the site is not considered explosive, as per various standards including NFPA 432, 49 CFR173.225, and one from the leading chemical *risk* management authorities (Dutch)[16]. In each case, the standard has a composition cutoff of BPO concentration <77% and ≥ 23% water. Of course, these concentration specifications are cutting it somewhat close to the concentrations in FHR's BPO, and that is probably by design. Again, there is a presumption that the material is being stored in a controlled manner as defined in these sources and others such as FM Data Sheet 7-80. The question then becomes whether there are circumstances under which the material may not be present in the specified concentrations or handled as required.

Arkema notes the following observations from tests they have performed:

Water - A slight change in water content will not make a big difference in the chemical's stability, however, larger changes will. Concentrations of 92% and higher BPO (and possibly less) are known to be dangerous. Arkema sells 98% BPO, but only in 1-pound bags vs. the 30-pound bags supplied to Peru.

[16] VROM, "Storage of Organic Peroxides – PGS 8", 1997.

Temperature – Arkema has exposed a 35-pound bag of 78% BPO to 150 °Fahrenheit conditions for a full week without significant degradation. However, there was a "forceful" decomposition at 160 °F. They also note that they ship this material to Europe in a non-temperature controlled environment. At lesser elevated temperatures (40-45 °C) BPO hydrolyzes to benzoyl peroxide, but this is strictly a quality issue. Arkema has ignited 75% BPO under a water sprinkler and while the BPO burned, it did not explode. Note that this was an 'open' ignition; if the material is contained and ignited, the pressure buildup can lead to a more significant event. For this reason, it is better to fight a peroxide fire with sprinklers rather than containment.

Quantity – The self-accelerating decomposition temperature (SADT) is a function of the quantity stored, and is basically a balance between the rate at which heat of decomposition is created and the rate at which it can be dissipated through a package. This is the reason that the more hazardous the peroxide, the less amount that is allowed to be stored in a single package. Since the suppliers follow the relevant codes and standards in this regard, the primary potential for storage conditions to be compromised is at the site. NPFA and others specify the allowable storage and fire-protection arrangements for BPO (quantities, spacing). In addition, Arkema notes that hazards can be introduced by removing the BPO from its packaging and combining it with the contents of other BPO bags, in a drum, for example. This larger quantity creates an inventory with a lowered SADT.

Contaminants and other Environmental Exposures – BPO can explode if exposed to contaminants such as cobalt, so it is critical that the use of intermediate storage containers (buckets, drums) be minimized and that the areas where BPO is kept are clear of such contaminants to the extent possible. Similarly, BPO should be kept away from areas where high voltage or electrostatic energy is present.

Based on the above, it is expected that BPO explosion hazards can be prevented by simply following standard storage and handling practices. The question then becomes whether there are any scenarios under which the standard practices could be compromised, and the amount of BPO that would be involved in a resulting explosion event.

Question 2 – How Much Inventory Could Participate in a Peroxide Explosion?

A member of the relevant NFPA committee was asked whether there was any inference that the storage layout requirements specified in the NFPA standard (that is, height of pallets, distances between rows of pallets) indicated that a single discrete explosion (millisecond) event would effectively only involve a pallet's worth or less of peroxide. His response was that such an inference should not be drawn, and that the separation distances were more of a consensus judgment regarding 'good practices' than anything.

Fundamentally, then, the amount of material that could participate in our millisecond peroxide explosion depends on the cause of the event. Following is a review of how each of the parameters discussed earlier might be disturbed from its specified state.

Water – The BPO could become dried out at the source, en route to the site, or at the site. If the BPO dries out at the source or en route, it seems likely that any explosion event would occur prior to its arrival on the site, since the material is subjected to more environmental disturbance prior to its arrival than afterward. Once on site, if the package integrity is maintained there should be no cause for drying out.

However, the following are considered plausible:

- *Remote storage area*: In the peroxide storage building the pallets are sealed, and so spillage of individual bag(s) should not occur. It is, however, considered credible for a forklift to puncture a few bags and perhaps not notice it.
- *Building 4*: If a bag is broken/spilled in the process area it is assumed that it will be noticed by the person who created the break/spill and cleaned up prior to its contents drying out. So the potential for drying out would seem to be limited to either (a) storing the peroxide for a prolonged period directly in front of ventilation fans and/or heaters or (b) intentionally removing some peroxide from a bag and being interrupted prior to utilizing it in a safe environment.

With respect to (a) above, the heaters in Building 4 are located near the ceiling, face horizontally, and are not near the 'normal' inside storage spots. It is possible for ventilation (fans) to be nearby. In the case of (b), entire bags are dumped directly into reactor addition tank (Cat tank) in preparation for charging to the reactor and are never removed from the packaging and combined with other packets prior to use. All additions are some multiple of 30 lb and 10 lb bags. Bags are removed from the cardboard boxes and piled on movable carts in order to make it easier to stage raw materials for each reactor.

Temperature – Arkema has tested the fire behavior of individual bags of peroxide, but not entire pallets. In the case of individual bags, the observation is that the fire burns from the outside in, but no explosion takes place. However, one can envision a scenario in which a fire is present (for whatever reason) and envelopes a pallet of BPO. The pallet would burn from the outside in, but potentially the heat generated in the fire could grow progressively until the interior bags in the pallet reach the SADT.

There are two versions of this event to consider:

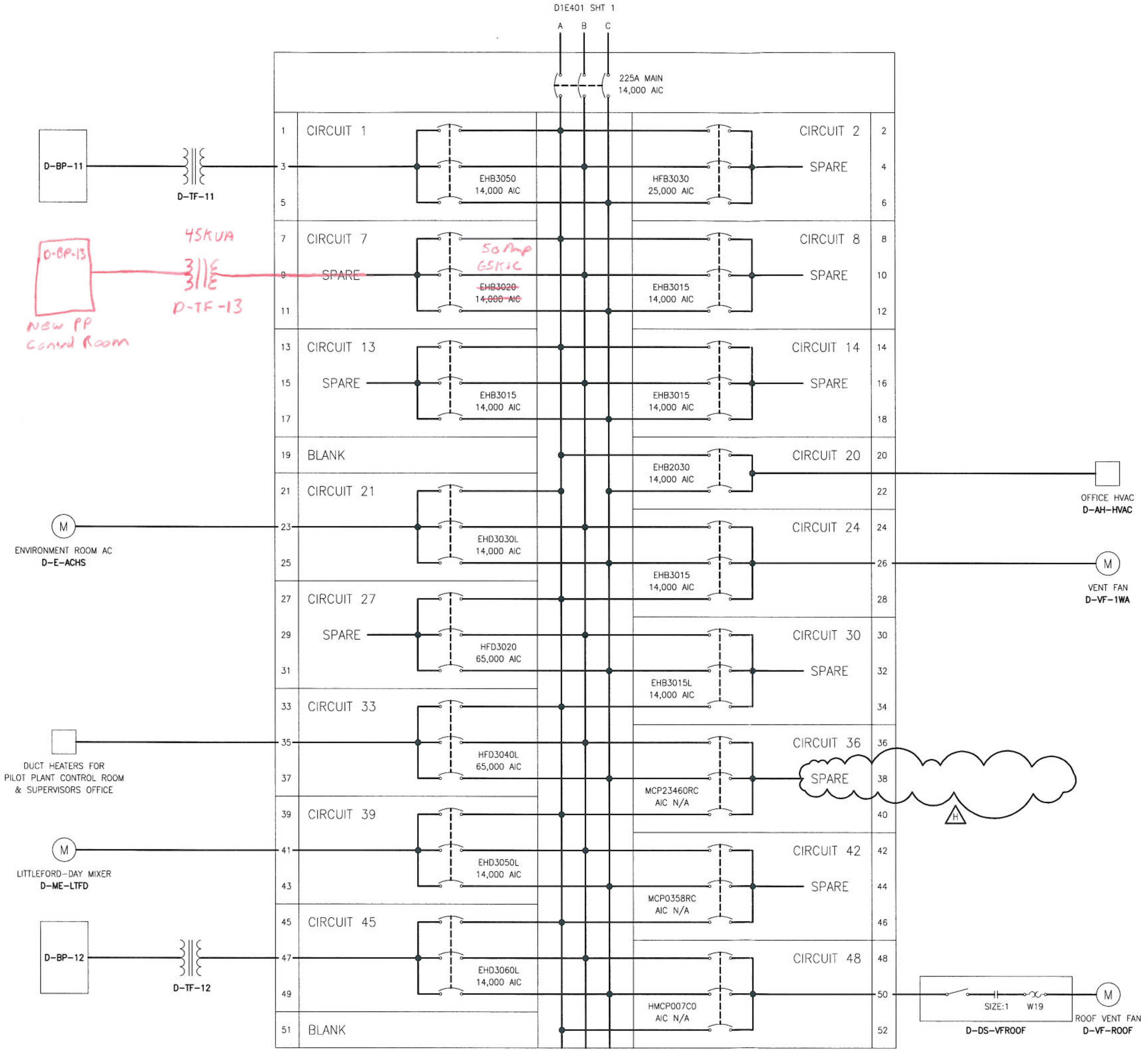
- *Fire inside remote storage area*: Pallets are kept in storage adjacent to each other, so a fire in one pallet is likely to spread to adjoining pallets. A fire impinging on other pallets could go undetected for some period of time and result in an explosion of BPO. Assume that a fire can affect two pallets to an explosion outcome in the sub-second time frame that defines a discrete explosion event.
- *Fire in Building 4*: It is assumed that a fire in the process area could also result in a pallet explosion, but that the presence of the fire would be obvious and that the building occupants would have evacuated. Since the site stages as much as 10,000 pounds of peroxide in the building, it is assumed that an event is similar to that in the remote storage area (two pallets). The effects of the explosion on building occupants are assumed to be applied only to people *other than* those in Building 4, who are presumed to have evacuated.

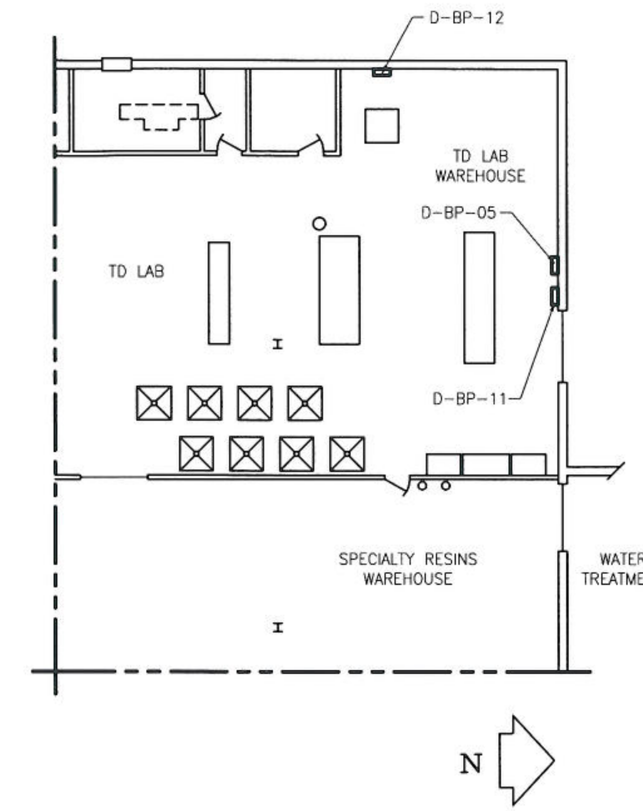
Quantity – Since entire bags of peroxide are used and dumped directly into the addition tank, the quantity of peroxide available to be in self-contact is limited to the single bag contents, and there is no lowering of the assumed temperature at which self-accelerating decomposition temperature occurs.

Contaminants and other Environmental Exposures - If the cause is contamination, then the amount participating in the explosion is probably limited to a few packages that are broken in a single event and happen to contact the contaminant in the area of the spill. Assume a 100-pound inventory participating in a discrete millisecond event. It is assumed that there are no high-voltage or electrostatic ignition sources, since these areas are Class 1 Div 1 rated.

Summary

Based on the above analysis, it is assumed that in the event of a fire, up to two pallets of BPO could be involved in an explosive event in both the remote storage area and in Building 4. The previous modeling will therefore be revised from the previous assumption of 48,000 pounds in the remote storage area and 10,000 pounds in Building 4 to a limit of 2880 pounds in each location.





ORIGINAL

BREAKER PANEL: D-BP-05
POWERED FROM: CUBICLE 200A
MCC: D-E-MCC2

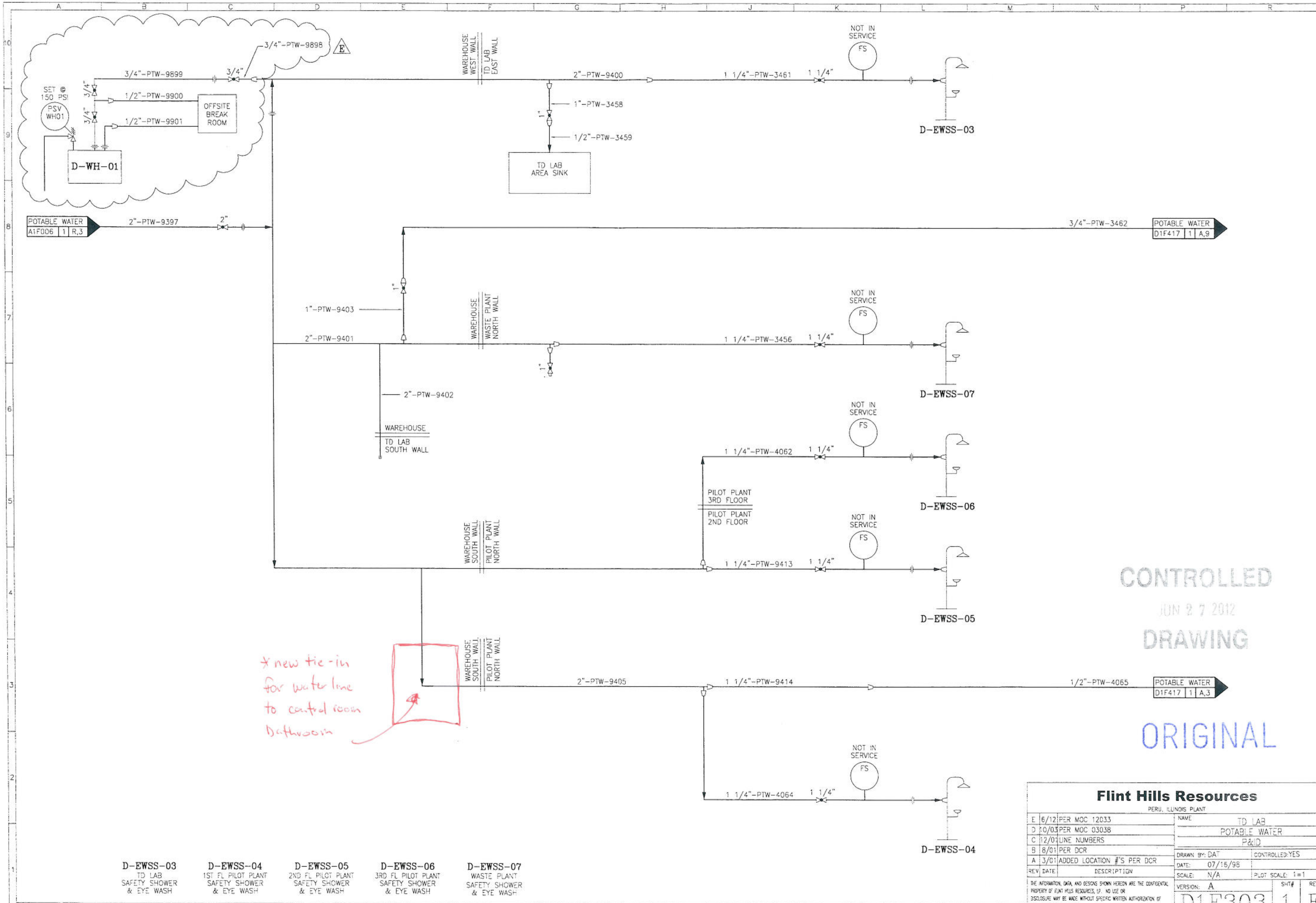
Flint Hills Resources
PERU, ILLINOIS PLANT

REV	DATE	DESCRIPTION
E	8/07	PER DCR 2007-021
D	5/06	PER DCR 2006-012
H	10/10	PER MOC 10062
G	7/10	PER DCR 2010-020
F	6/10	PER MOC 10032

NAME: TD LAB
BREAKER PANEL D-BP-05
CIRCUIT DESIGNATIONS

DRAWN BY: DAT | CONTROLLED: YES
DATE: 01/07/99
SCALE: NA | PLOT SCALE: 1=1
VERSION: A

D1E401	SHT# 2	REV# H



Flint Hills Resources
PERU, ILLINOIS PLANT

REV	DATE	DESCRIPTION
E	6/12	PER MOC 12033
D	10/03	PER MOC 03038
C	12/01	LINE NUMBERS
B	8/01	PER DCR
A	3/01	ADDED LOCATION #'S PER DCR

NAME: TD LAB POTABLE WATER P&ID
DRAWN BY: DAT | CONTROLLED: YES
DATE: 07/16/98
SCALE: N/A | PLOT SCALE: 1=1
VERSION: A | SHT# 1 | REV# E
D1F303

Validated

ILLINOIS Environmental Protection Agency
2013 Hazardous Waste Report
Form GM – Generation and Management

US EPA ID : ILD087154555 IL EPA ID : 0990850005

SECTION 1. WASTE DESCRIPTION

A. Waste Description: CONTAMINATED SOILS

B. EPA Hazardous Waste Code(s) : D006 D008

C. Source Code : G31 D. Form Code : W301 Management Method :

E. Waste Minimization Code: X

SECTION 2. QUANTITY GENERATED:

A. UOM : 3. Pounds (lbs) Density : 9.00 lb/gal .

B. Quantity Generated in Current Reporting Year : 2,290,458.0

SECTION 3: QUANTITY MANAGED ON-SITE:

Did this location manage some or all of this waste in RCRA or UIC regulated treatment, recycling, or disposal units at this location? (DO NOT include RCRA exempt processes.) N

On-Site System1:Management Method : Quantity managed on-site this year : 0.0

On-Site System2:Management Method : Quantity managed on-site this year : 0.0

SECTION 4. OFF-SITE SHIPMENT

A. Was any of this waste shipped off site this reporting year? Y

SITE 1.

B. U.S. EPA ID No. of facility waste was shipped to : ILD000666206

C.Management method shipped to : H132

D. Total quantity shipped in this reporting year : 2,290,458.0

SITE 2.

B. U.S. EPA ID No. of facility waste was shipped to :

C. Management method shipped to :

D. Total quantity shipped in this reporting year : 0.0

SITE 3.

B. U.S. EPA ID No. of facility waste was shipped to :

C. Management method shipped to :

D. Total quantity shipped in this reporting year : 0.0

SITE 4.

B. U.S. EPA ID No. of facility waste was shipped to :

C. Management method shipped to :

D. Total quantity shipped in this reporting year : 0.0

SITE 5.

B. U.S. EPA ID No. of facility waste was shipped to :

C. Management method shipped to :

D. Total quantity shipped in this reporting year : 0.0

COMMENTS : N

A134003DL 55917

774904032 SC RPW 3/3/2011

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number: ILD087154555	2. Page 1 of 1	3. Emergency Response Phone: (800) 483-3718	4. Manifest Tracking Number: 006050933 FLE

GENERATOR

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport Inc
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000668206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 23	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. A134003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	M C S	5	7	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	X Larry L Blood Jr	Larry L Blood Jr	05	07	13
Transporter 2					

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H110			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
Leonard E Gray	[illegible]	05	07	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

FHRPRU001777

#126 J. Tritschel AJ34003EIL 50934

774004630 SCRPW 3/3/2011

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
ILD087154555	1	(800) 483-3718	006050934 FLE

GENERATOR

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5481

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport Inc
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 22	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
AJ34003EIL ER83171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	M C Schmidt	5	8	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	John Tritschel JR	J Tritschel	5	8	13
Transporter 2					

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[illegible]	05	08	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

126 J Tuttle 774904832 A134003EIL SCPPW 3/3/2011 55981

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
ILD087154555	1	(800) 483-3718	006050935 FLE

GENERATOR

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5461

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport Inc — U.S. EPA ID Number: PAD987347518

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040

U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	~~E17~~ 22	~~Y~~ T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. A134003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C. Schmidt	M C Schmidt	5	07	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name	Signature	Month	Day	Year
John H Tritschuh JR	[signature]	5	7	13

Transporter 2 Printed/Typed Name	Signature	Month	Day	Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number:
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H110			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
Edward F Grant	[signature]	05	07	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001779

A1340003EIL 55944

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: ILD087154656
2. Page 1 of: 1
3. Emergency Response Phone: (800) 483-3718
4. Manifest Tracking Number: 006050936 FLE

5. Generator's Name and Mailing Address:
Flint Hills Resources
501 Brunner Street
Peru, IL 61354

Generator's Site Address (if different than mailing address): SAME

Generator's Phone: (815) 224-5451

6. Transporter 1 Company Name: US Bulk Transport Inc — U.S. EPA ID Number: PAD987247518

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426

U.S. EPA ID Number: ILD000666206

Facility's Phone: (708) 596-7040

GENERATOR

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 23	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1 A1340003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C. Schmidt — Signature: [signature] — Month 5 Day 08 Year 13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: LARRY L BLOOD JR — Signature: [signature] — Month 05 Day 08 Year 13
Transporter 2 Printed/Typed Name: — Signature: — Month Day Year

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number:
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: [illegible] — Signature: [signature] — Month Day Year

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

5/10/2013
A134003 EIL
775167139 SC PPW 3/3/2011 311-5

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number: ILD087154555	2. Page 1 of 1	3. Emergency Response Phone: 800-483-3718	4. Manifest Tracking Number: 006051009 FLE

GENERATOR

5. Generator's Name and Mailing Address: Flint Hills Resources, 501 Brunner St, Peru, IL 61354
Generator's Site Address (if different than mailing address): SAME
Generator's Phone: 815-224-5451

6. Transporter 1 Company Name: US Bulk Transport, Inc. — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address: EQ Illinois, 16435 South Center Ave, Harvey, IL 60426 — U.S. EPA ID Number: ILD000666206
Facility's Phone: 708-596-7040

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. RQ NA3077 Hazardous Waste Solid NOS (Lead Cadmium) 9, PG III (D006, D008)	1	DT	ES 22	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information: 1 A134003 EIL ERG #171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt — Signature: [signature] — Month 05 Day 10 Year 13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Scott A Goodenow — Signature: [signature] — Month 05 Day 10 Year 13
Transporter 2 Printed/Typed Name: — Signature: — Month Day Year

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. H110	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Edward K Fry — Signature: [signature] — Month 05 Day 10 Year 13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

FHRPRU001781

Received 5/17/2013 775167139 SC PPW 3/3/2011 A134003EIL 58994

Print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: ILD087154555
2. Page 1 of 1
3. Emergency Response Phone: 800-483-3718
4. Manifest Tracking Number: 006051010 FLE

GENERATOR

5. Generator's Name and Mailing Address: Flint Hills Resources, 501 Brunner St., Peru, IL 61354
Generator's Site Address (if different than mailing address): SAME
Generator's Phone: 815-224-5451

6. Transporter 1 Company Name: US Bulk Transport, Inc. — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address: EQ Illinois, 16435 South Center Avenue, Harvey, IL 60426 — U.S. EPA ID Number: ILD000666206
Facility's Phone: 708-596-7040

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
	1. RQ NA3077, Hazardous Waste Solid N.O.S (Lead, Cadmium) 9, PG III (D006, D008)	001	DT	EST 23	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. A134003EIL ERG# 171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C. Schmidt — Signature: MCS — Month 05 Day 10 Year 13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Larry L Blood Jr. — Signature: Larry L Blood Jr. — Month 05 Day 10 Year 13
Transporter 2 Printed/Typed Name: — Signature: — Month Day Year

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)
1. H110 2. 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Leonard [illegible] — Signature: [illegible] — Month 05 Day [illegible] Year 13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

A134003EIL 775167139 SC RPW 3/3/2011 SS [illegible]

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number ILD087154566	2. Page 1 of 1	3. Emergency Response Phone (800)483-3718	4. Manifest Tracking Number 006560980 FLE

GENERATOR

5. Generator's Name and Mailing Address
Flint Hills Resources
801 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5461

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: U.S. Bulk, Inc. — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey IL 60426
Facility's Phone: (708)596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	1	DT	20	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1.A134003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt — Signature: M C Schmidt — Month 4 Day 18 Year 2013

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: R. Rogers — Signature: R. Rogers — Month 4 Day 18 Year 13
Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. H110	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: [illegible] — Signature: [illegible] — Month 04 Day 19 Year 13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001783

A134003EIL 55665

775167139 SC PPW 3/3/2011

...e print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154555	1	(800) 483-3718	006560981 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
601 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk, Inc. — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

GENERATOR

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S. (LEAD, CADMIUM), 9, PG III (D006, D008)	1	DT	20	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1.A134003EIL ERG#171
Michael Schmidt 4/18/13

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt | Signature: M C Schmidt | Month 4 Day 18 Year 2013

INT'L
16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER
17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Billy Workman | Signature: Billy Workman | Month 4 Day 18 Year 13
Transporter 2 Printed/Typed Name | Signature | Month Day Year

DESIGNATED FACILITY
18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H110			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Steve Parr | Signature: Steve Parr | Month 04 Day 19 Year 13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001784

A134003EIL

SC PPW 3/3/2011

55667

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number ILD087154555	2. Page 1 of 1	3. Emergency Response Phone (800) 483-3718	4. Manifest Tracking Number 006560982 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport Inc.
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name
U.S. EPA ID Number

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	1	DT	22	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. A134003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt — Signature: [signature] — Month 4 Day 18 Year 2013

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Lonnie Henry — Signature: [signature] — Month 4 Day 11 Year 2013
Transporter 2 Printed/Typed Name — Signature — Month Day Year

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1. H110	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name — Signature — Month 04 Day 11 Year 13

GENERATOR / INT'L / TRANSPORTER / DESIGNATED FACILITY

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001785

A134C03EN 36933

775167139 SL PPW 3/3/2011

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154556	1	(800) 483-3718	006560983 FLE

GENERATOR

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport Inc
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 23	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. A1D460YE3L 2366171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	[illegible signature]	05	08	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit: ______
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	LARRY L BLOOD JR	Larry L Blood Jr	05	08	13
Transporter 2					

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[illegible signature]	05	[illegible]	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001786

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD037154588	1	(800) 483-3718	006560984 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: US Bulk Transport — U.S. EPA ID Number: DAD987307515

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 22	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1LAI1400281L ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt — Signature: — Month 5 Day 8 Year 13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: John H Fritschel Jr — Signature: — Month 5 Day 8 Year 13
Transporter 2 Printed/Typed Name: — Signature: — Month Day Year

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number:
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)
1. 2. 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: — Signature: — Month Day Year

Sections (side labels): GENERATOR / INT'L / TRANSPORTER / DESIGNATED FACILITY

05/29/2013 A134003EIL 55948

775167139 SC PPW 3/3/2011

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087184555	1	(800) 483-3718	006560985 FLE

5. Generator's Name and Mailing Address

Flint Hills Resources
601 Brunner Street
Peru, IL 61354

Generator's Site Address (if different than mailing address)

SAME

Generator's Phone: (815) 224-5461

6. Transporter 1 Company Name: US Bulk Transport Inc. — U.S. EPA ID Number: PAD987847575

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address — U.S. EPA ID Number: ILD000666206

EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426

Facility's Phone: (708) 596-7040

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	1	DT	EST 14,000	P	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information

1. A134003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C. Schmidt — Signature: M C Schmidt — Month 05 Day 28 Year 2013

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Scott A Goodenow — Signature: Scott A Goodenow — Month 05 Day 28 Year 2013

Transporter 2 Printed/Typed Name — Signature — Month Day Year

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name — Signature — Month Day Year

GENERATOR / INT'L / TRANSPORTER / DESIGNATED FACILITY

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

A134003EIC 53991

770197139 SCHPW 2/3/2011

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154565	1	(800) 483-3718	006560986 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
601 Brunner Street
Peru, IL 61354

Generator's Site Address (if different than mailing address)
SAME

Generator's Phone: (815) 224-6461

6. Transporter 1 Company Name: US Bulk Transport, Inc — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426

U.S. EPA ID Number: ILD000666206

Facility's Phone: (708) 596-7040

GENERATOR

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD CADMIUM), 9, PG III (D006, D008)	1	DT	EST 22	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. A134003EIC ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C. Schmidt	M C Schmidt	05	09	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name	Signature	Month	Day	Year
Scott A. Goodrow	Scott A Goodrow	05	09	13

Transporter 2 Printed/Typed Name	Signature	Month	Day	Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[illegible]	05	[illegible]	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

Received 5/29/2013   775167139   H 13400361C   PPW 3/3/2011   55955

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154555	1	(800) 483-3718	006560987 FLE

GENERATOR

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru IL 61354

Generator's Site Address (if different than mailing address)
SAME

Generator's Phone: (815) 224-5451

6. Transporter 1 Company Name: US Bulk Transport Inc.
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
LQ Illinois
16435 South Center Avenue
Harvey IL 60426
Facility's Phone: (708) 596-1916
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 23	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
[illegible]

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	Michael C Schmidt	05	09	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name	Signature	Month	Day	Year
Larry L Blood Jr.	Larry Blood	05	09	13

Transporter 2 Printed/Typed Name	Signature	Month	Day	Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[illegible]	05	[illegible]	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

#126 John Tritschuh 7751187139 A13H003EIL 3C PPW 3/3/2011 33966

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154558	1	(800) 483-3718	006560988 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: US Bulk Transport, Inc.
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S. (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 22	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. A13H003EIL ERG#171

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C. Schmidt	Michael C. Schmidt	05	09	13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials

	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	John H Tritschuh JR	[signature]	5	9	13
Transporter 2					

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[signature]	05	09	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	IL D 087 154 565	1	(800) 483-3718	006560989 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
601 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport, Inc
U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ NA3077, HAZARDOUS WASTE, SOLID, N.O.S. (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	Est 23	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1CA13N06?EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	M C S	05	09	13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials

	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	LARRY L BLOOD JR	Larry L Blood	05	09	13
Transporter 2					

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
Leonard K Itany				

GENERATOR / INT'L / TRANSPORTER / DESIGNATED FACILITY

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. **DESIGNATED FACILITY TO GENERATOR**

FHRPRU001792

#126 [illegible]   A134003EIL   55963

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number [illegible]	2. Page 1 of 1	3. Emergency Response Phone [illegible]	4. Manifest Tracking Number 006560990 FLE

5. Generator's Name and Mailing Address
[illegible] Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport, Inc — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey IL 60426
Facility's Phone: (708)596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S. (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 22	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. A134003EIL   ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt — Signature: [signature] — Month 05 Day 09 Year 13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: John A Tritsch Jr — Signature: [signature] — Month 5 Day 9 Year 13
Transporter 2 Printed/Typed Name — Signature — Month Day Year

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)
1. 2. 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: [illegible] — Signature: [signature] — Month [illegible] Day [illegible] Year [illegible]

GENERATOR | INT'L | TRANSPORTER | DESIGNATED FACILITY

311-5 A13H003... 55964

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154655	1	(800) 483-3718	006560991 FLE

5. Generator's Name and Mailing Address: Flint Hills Resources, 501 Brunner Street, Peru, IL 61354

Generator's Site Address (if different than mailing address): SAME

Generator's Phone: (815) 224-5451

6. Transporter 1 Company Name: US Bulk Transport, Inc — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address: EQ Illinois, 16435 South Center Avenue, Harvey IL 60426 — U.S. EPA ID Number: ILD000666206

Facility's Phone: (708) 596-7040

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	1	DT	55 32	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information

T:A11A052E11 ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.

I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	[signature]	05	09	13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit: ______

Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name	Signature	Month	Day	Year
Scott A Goodenow	[signature]	05	09	13
Transporter 2 Printed/Typed Name	Signature	Month	Day	Year

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
Leonard F. Tiny	[signature]	[illegible]	[illegible]	[illegible]

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. DESIGNATED FACILITY TO GENERATOR

GENERATOR — INT'L — TRANSPORTER — DESIGNATED FACILITY

FHRPRU001794

A134003EIL 56980

776157139 SC PPW 3/3/2011

...nt or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: ILD087154555
2. Page 1 of 1
3. Emergency Response Phone: (800) 483-3718
4. **Manifest Tracking Number**: 006560992 FLE

5. Generator's Name and Mailing Address:
Flint Hills Resources
501 Brunner Street
Peru, IL 61354

Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: US Bulk Transport Inc — U.S. EPA ID Number: PAD987847525

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426

Facility's Phone: (708) 596-2040

U.S. EPA ID Number: ILD000666206

GENERATOR

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 23	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1.A134003EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael C Schmidt — Signature: M C Schmidt — Month 05 Day 10 Year 13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: LARRY L BLOOM JR — Signature: Larry L Bloom — Month 05 Day 10 Year 13

Transporter 2 Printed/Typed Name: — Signature: — Month Day Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H110			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name: [illegible] — Signature: [illegible] — Month 05 Day 10 Year 13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001795

A134003IL 35978

...or type. (Form designed for use on elite (12-pitch) typewriter.) 7701C7139 SC PPW 3/3/2011 Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
	ILD087154555	1	(800) 483-3718	006550993 FLE

5. Generator's Name and Mailing Address
Flint Hills Resources
501 Brunner Street
Peru, IL 61354
Generator's Phone: (815) 224-5451

Generator's Site Address (if different than mailing address)
SAME

6. Transporter 1 Company Name: US Bulk Transport, INC — U.S. EPA ID Number: PAD9873847515

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426
Facility's Phone: (708) 596-7040
U.S. EPA ID Number: ILD000666206

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
X	1. RQ NA3077 HAZARDOUS WASTE SOLID N.O.S. (LEAD, CADMIUM), 9, PG III (D006, D008)	001	DT	EST 22	T	D006	D008	
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. A134006EIL ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C Schmidt	M C Schmidt	05	10	13

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials

Transporter	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	John A Trmuschuk JR	[signature]	5	10	13
Transporter 2					

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H111			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
Steven Fisher	[signature]	05	10	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete. **DESIGNATED FACILITY TO GENERATOR**

31-5 A134005E10 55949

775187139 SC PPW 3/3/2011

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: ILD087164555
2. Page 1 of 1
3. Emergency Response Phone: (800) 483-3718
4. Manifest Tracking Number: 006560994 FLE

5. Generator's Name and Mailing Address:
Flint Hills Resources
501 Brunner Street
Peru, IL 61354

Generator's Site Address (if different than mailing address): SAME

Generator's Phone: (815) 224-5451

6. Transporter 1 Company Name: US Bulk Transport INC — U.S. EPA ID Number: PAD987347515

7. Transporter 2 Company Name: — U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
EQ - Illinois
16435 South Center Avenue
Harvey, IL 60426

U.S. EPA ID Number: ILD000666206

Facility's Phone: (708) 596-7040

GENERATOR

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. RQ, NA3077, HAZARDOUS WASTE, SOLID, N.O.S., (LEAD, CADMIUM), 9, PG III (D006, D008)	1	DT	EST 22	T	D006 D008
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. A134005E10 ERG#171

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name	Signature	Month	Day	Year
Michael C. Schmidt	[signature]	05	10	13

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

	Printed/Typed Name	Signature	Month	Day	Year
Transporter 1	Scott A. Gardenow	[signature]	05	10	13
Transporter 2					

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) — U.S. EPA ID Number:

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H110			

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[signature]	05	10	13

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR

FHRPRU001797

Prairie Analytical Systems, INCORPORATED

Wednesday, May 1, 2013

Michael Schmidt
Flint Hills Resources
501 Brunner Street
Peru, IL 61354

TEL: (815) 224-5451

FAX: NA

RE: TD Control Room Ex Peru, IL PAS WO: 13D0446

Prairie Analytical Systems, Inc. received 5 sample(s) on 4/22/2013 for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria unless otherwise noted.

This report shall not be reproduced, except in full, without the prior written consent of Prairie Analytical Systems, Inc.

If you have any questions, please feel free to contact me at (217) 753-1148.

Respectfully submitted,

DRAFT REPORT
DATA SUBJECT TO CHANGE

Certifications: NELAP/NELAC - IL #100323

LABORATORY RESULTS

Client: Flint Hills Resources
Project: TD Control Room Ex Peru, IL — **Lab Order:** 13D0446
Client Sample ID: DRAFT: Comp 13 A — **Lab ID:** 13D0446-01
Collection Date: 4/17/13 0:00 — **Matrix:** Solid

Prairie Analytical Systems, Inc.

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
DRAFT: TCLP Volatile Organic Compounds by GC-MS									
*Benzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*2-Butanone	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*Carbon tetrachloride	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*Chlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*Chloroform	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*1,4-Dichlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*1,2-Dichloroethane	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*1,1-Dichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*Tetrachloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*Trichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
*Vinyl chloride	U	200		µg/L	10	4/24/13 12:32	4/24/13 16:12	SW 8260B Re	JKA
DRAFT: TCLP Semi-Volatile Organic Compounds by GC-MS									
*1,4-Dichlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*2,4-Dinitrotoluene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*Hexachlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*Hexachlorobutadiene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*Hexachloroethane	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*2-Methylphenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
3 & 4-Methylphenol	U	20.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*Nitrobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*Pentachlorophenol	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
Pyridine	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*2,4,5-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
*2,4,6-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 13:38	SW 8270C	BDP
DRAFT: Polychlorinated Biphenyls by GC-ECD									
*Aroclor 1016	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
*Aroclor 1221	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
*Aroclor 1232	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
*Aroclor 1242	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
*Aroclor 1248	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
*Aroclor 1254	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
*Aroclor 1260	U	40.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 19:42	SW 8082	BDP
DRAFT: TCLP Metals by ICP-MS									
*Arsenic	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
***Barium**	**0.325**	0.0300		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
***Cadmium**	**2.42**	0.00600		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
*Chromium	U	0.00480		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
***Lead**	**0.252**	0.00750		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
*Mercury	U	0.000600		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
*Selenium	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC
*Silver	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 16:59	SW 6020A	JTC

DRAFT: Conventional Chemistry Parameters

FHRPRU001799

LABORATORY RESULTS

Client:	Flint Hills Resources		
Project:	TD Control Room Ex Peru, IL	**Lab Order:**	13D0446
Client Sample ID:	DRAFT: Comp 13 A	**Lab ID:**	13D0446-01
Collection Date:	4/17/13 0:00	**Matrix:**	Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
***Cyanide**	**1.55**	0.294		mg/Kg dry	1	4/24/13 10:44	4/25/13 8:17	SW 9014	CCD
*Ignitability (Flash Point)	>200	50.0		°F	1	4/23/13 15:30	4/23/13 16:30	SW 1010 (M)	JLS
*Paint Filter	Pass			P/F	1	4/23/13 15:25	4/23/13 15:30	SW 9095A	JLS
***pH**	**7.1**	0.010		pH Units	1	4/23/13 12:00	4/23/13 13:57	SW 9045C	CCD
*Phenolics	U	6.11		mg/Kg dry	1	4/24/13 9:50	4/24/13 17:50	SW 9065 (M)	CCD
*Reactive Sulfide	U	9.58		mg/Kg dry	1	4/30/13 9:36	4/30/13 15:31	SW 9034	RSR
Percent Solids	**81.9**	0.100		%	1	4/23/13 15:40	4/24/13 8:15	ASTM D2216	JLS
Precision Petroleum Labs, Inc									
DRAFT:									
Extractable Organic Halides	U	1		mg/Kg	1	4/26/13 0:00	4/26/13 0:00	SW 9023	SUB

LABORATORY RESULTS

Client:	Flint Hills Resources		
Project:	TD Control Room Ex Peru, IL	**Lab Order:**	13D0446
Client Sample ID:	DRAFT: Comp 13 B	**Lab ID:**	13D0446-02
Collection Date:	4/17/13 0:00	**Matrix:**	Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
DRAFT: TCLP Volatile Organic Compounds by GC-MS									
*Benzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*2-Butanone	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*Carbon tetrachloride	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*Chlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*Chloroform	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*1,4-Dichlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*1,2-Dichloroethane	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*1,1-Dichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*Tetrachloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*Trichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
*Vinyl chloride	U	200		µg/L	10	4/24/13 12:32	4/24/13 15:38	SW 8260B Re	JKA
DRAFT: TCLP Semi-Volatile Organic Compounds by GC-MS									
*1,4-Dichlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*2,4-Dinitrotoluene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*Hexachlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*Hexachlorobutadiene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*Hexachloroethane	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*2-Methylphenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
3 & 4-Methylphenol	U	20.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*Nitrobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*Pentachlorophenol	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
Pyridine	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*2,4,5-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
*2,4,6-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:11	SW 8270C	BDP
DRAFT: Polychlorinated Biphenyls by GC-ECD									
*Aroclor 1016	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
*Aroclor 1221	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
*Aroclor 1232	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
*Aroclor 1242	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
*Aroclor 1248	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
*Aroclor 1254	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
*Aroclor 1260	U	39.3		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:16	SW 8082	BDP
DRAFT: TCLP Metals by ICP-MS									
*Arsenic	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
***Barium**	**0.165**	0.0300		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
***Cadmium**	**1.17**	0.00600		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
*Chromium	U	0.00480		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
***Lead**	**2.50**	0.00750		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
*Mercury	U	0.000600		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
*Selenium	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
*Silver	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:08	SW 6020A	JTC
DRAFT: Conventional Chemistry Parameters									

LABORATORY RESULTS

Client:	Flint Hills Resources		
Project:	TD Control Room Ex Peru, IL	**Lab Order:**	13D0446
Client Sample ID:	DRAFT: Comp 13 B	**Lab ID:**	13D0446-02
Collection Date:	4/17/13 0:00	**Matrix:**	Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
*Cyanide	U	0.298		mg/Kg dry	1	4/24/13 13:10	4/25/13 8:17	SW 9014	CCD
*Ignitability (Flash Point)	>200	50.0		°F	1	4/23/13 15:30	4/23/13 16:30	SW 1010 (M)	JLS
*Paint Filter	Pass			P/F	1	4/23/13 15:25	4/23/13 15:30	SW 9095A	JLS
***pH**	**7.2**	0.010		pH Units	1	4/23/13 12:00	4/23/13 13:57	SW 9045C	CCD
*Phenolics	U	5.61		mg/Kg dry	1	4/24/13 9:50	4/24/13 17:50	SW 9065 (M)	CCD
*Reactive Sulfide	U	9.12		mg/Kg dry	1	4/30/13 9:36	4/30/13 15:31	SW 9034	RSR
Percent Solids	**84.0**	0.100		%	1	4/23/13 15:40	4/24/13 8:15	ASTM D2216	JLS
Precision Petroleum Labs, Inc									
DRAFT:									
Extractable Organic Halides	U	1		mg/Kg	1	4/26/13 0:00	4/26/13 0:00	SW 9023	SUB

LABORATORY RESULTS

Client:	Flint Hills Resources		
Project:	TD Control Room Ex Peru, IL	**Lab Order:**	13D0446
Client Sample ID:	DRAFT: Comp 13 C	**Lab ID:**	13D0446-03
Collection Date:	4/17/13 0:00	**Matrix:**	Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
DRAFT: TCLP Volatile Organic Compounds by GC-MS									
*Benzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*2-Butanone	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*Carbon tetrachloride	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*Chlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*Chloroform	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*1,4-Dichlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*1,2-Dichloroethane	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*1,1-Dichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*Tetrachloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*Trichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
*Vinyl chloride	U	200		µg/L	10	4/24/13 12:32	4/24/13 15:05	SW 8260B Re	JKA
DRAFT: TCLP Semi-Volatile Organic Compounds by GC-MS									
*1,4-Dichlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*2,4-Dinitrotoluene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*Hexachlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*Hexachlorobutadiene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*Hexachloroethane	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*2-Methylphenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
3 & 4-Methylphenol	U	20.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*Nitrobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*Pentachlorophenol	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
Pyridine	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*2,4,5-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
*2,4,6-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 14:44	SW 8270C	BDP
DRAFT: Polychlorinated Biphenyls by GC-ECD									
*Aroclor 1016	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
*Aroclor 1221	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
*Aroclor 1232	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
*Aroclor 1242	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
*Aroclor 1248	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
*Aroclor 1254	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
*Aroclor 1260	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 20:49	SW 8082	BDP
DRAFT: TCLP Metals by ICP-MS									
*Arsenic	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
***Barium**	**0.119**	0.0300		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
***Cadmium**	**1.72**	0.00600		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
*Chromium	U	0.00480		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
***Lead**	**0.579**	0.00750		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
*Mercury	U	0.000600		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
*Selenium	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
*Silver	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:17	SW 6020A	JTC
DRAFT: Conventional Chemistry Parameters									

LABORATORY RESULTS

Client:	Flint Hills Resources		
Project:	TD Control Room Ex Peru, IL	**Lab Order:**	13D0446
Client Sample ID:	DRAFT: Comp 13 C	**Lab ID:**	13D0446-03
Collection Date:	4/17/13 0:00	**Matrix:**	Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
*Cyanide	U	0.296		mg/Kg dry	1	4/24/13 13:10	4/25/13 8:17	SW 9014	CCD
*Ignitability (Flash Point)	>200	50.0		°F	1	4/23/13 15:30	4/23/13 16:30	SW 1010 (M)	JLS
*Paint Filter	Pass			P/F	1	4/23/13 15:25	4/23/13 15:30	SW 9095A	JLS
***pH**	**7.3**	0.010		pH Units	1	4/23/13 12:00	4/23/13 13:57	SW 9045C	CCD
*Phenolics	U	5.64		mg/Kg dry	1	4/24/13 9:50	4/24/13 17:50	SW 9065 (M)	CCD
*Reactive Sulfide	U	9.29		mg/Kg dry	1	4/30/13 9:36	4/30/13 15:31	SW 9034	RSR
Percent Solids	**84.4**	0.100		%	1	4/23/13 15:40	4/24/13 8:15	ASTM D2216	JLS
Precision Petroleum Labs, Inc									
DRAFT:									
Extractable Organic Halides	U	1		mg/Kg	1	4/26/13 0:00	4/26/13 0:00	SW 9023	SUB

LABORATORY RESULTS

Client:	Flint Hills Resources		
Project:	TD Control Room Ex Peru, IL	**Lab Order:**	13D0446
Client Sample ID:	DRAFT: Comp 13 D	**Lab ID:**	13D0446-04
Collection Date:	4/17/13 0:00	**Matrix:**	Solid

Prairie Analytical Systems, Inc.

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
DRAFT: TCLP Volatile Organic Compounds by GC-MS									
*Benzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*2-Butanone	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*Carbon tetrachloride	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*Chlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*Chloroform	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*1,4-Dichlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*1,2-Dichloroethane	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*1,1-Dichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*Tetrachloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*Trichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
*Vinyl chloride	U	200		µg/L	10	4/24/13 12:32	4/24/13 14:32	SW 8260B Re	JKA
DRAFT: TCLP Semi-Volatile Organic Compounds by GC-MS									
*1,4-Dichlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*2,4-Dinitrotoluene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*Hexachlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*Hexachlorobutadiene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*Hexachloroethane	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*2-Methylphenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
3 & 4-Methylphenol	U	20.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*Nitrobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*Pentachlorophenol	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
Pyridine	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*2,4,5-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
*2,4,6-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:16	SW 8270C	BDP
DRAFT: Polychlorinated Biphenyls by GC-ECD									
*Aroclor 1016	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
*Aroclor 1221	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
*Aroclor 1232	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
*Aroclor 1242	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
*Aroclor 1248	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
*Aroclor 1254	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
*Aroclor 1260	U	39.8		µg/Kg dry	1	4/23/13 14:22	4/23/13 21:23	SW 8082	BDP
DRAFT: TCLP Metals by ICP-MS									
*Arsenic	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
***Barium**	**0.250**	0.0300		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
***Cadmium**	**0.688**	0.00600		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
*Chromium	U	0.00480		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
***Lead**	**0.105**	0.00750		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
*Mercury	U	0.000600		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
*Selenium	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC
*Silver	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:26	SW 6020A	JTC

DRAFT: Conventional Chemistry Parameters

LABORATORY RESULTS

Client: Flint Hills Resources
Project: TD Control Room Ex Peru, IL — **Lab Order:** 13D0446
Client Sample ID: DRAFT: Comp 13 D — **Lab ID:** 13D0446-04
Collection Date: 4/17/13 0:00 — **Matrix:** Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
				Prairie Analytical Systems, Inc.					
***Cyanide**	**0.531**	0.304		mg/Kg dry	1	4/24/13 13:10	4/25/13 8:17	SW 9014	CCD
*Ignitability (Flash Point)	>200	50.0		°F	1	4/24/13 10:00	4/24/13 11:00	SW 1010 (M)	CCD
*Paint Filter	Pass			P/F	1	4/24/13 10:00	4/24/13 10:05	SW 9095A	CCD
***pH**	**7.4**	0.010		pH Units	1	4/23/13 12:00	4/23/13 14:22	SW 9045C	CCD
*Phenolics	U	6.07		mg/Kg dry	1	4/24/13 12:18	4/24/13 17:50	SW 9065 (M)	CCD
*Reactive Sulfide	U	9.20		mg/Kg dry	1	4/30/13 9:36	4/30/13 15:31	SW 9034	RSR
Percent Solids	**82.4**	0.100		%	1	4/23/13 15:40	4/24/13 8:15	ASTM D2216	JLS
				Precision Petroleum Labs, Inc					
DRAFT:									
Extractable Organic Halides	U	1		mg/Kg	1	4/26/13 0:00	4/26/13 0:00	SW 9023	SUB

LABORATORY RESULTS

Client: Flint Hills Resources
Project: TD Control Room Ex Peru, IL **Lab Order:** 13D0446
Client Sample ID: DRAFT: Comp 13 E **Lab ID:** 13D0446-05
Collection Date: 4/17/13 0:00 **Matrix:** Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
DRAFT: TCLP Volatile Organic Compounds by GC-MS									
*Benzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*2-Butanone	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*Carbon tetrachloride	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*Chlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*Chloroform	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*1,4-Dichlorobenzene	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*1,2-Dichloroethane	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*1,1-Dichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*Tetrachloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*Trichloroethene	U	250		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
*Vinyl chloride	U	200		µg/L	10	4/24/13 12:32	4/24/13 13:59	SW 8260B Re	JKA
DRAFT: TCLP Semi-Volatile Organic Compounds by GC-MS									
*1,4-Dichlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*2,4-Dinitrotoluene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*Hexachlorobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*Hexachlorobutadiene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*Hexachloroethane	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*2-Methylphenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
3 & 4-Methylphenol	U	20.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*Nitrobenzene	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*Pentachlorophenol	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
Pyridine	U	50.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*2,4,5-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
*2,4,6-Trichlorophenol	U	10.0		µg/L	1	4/24/13 13:02	4/25/13 15:50	SW 8270C	BDP
DRAFT: Polychlorinated Biphenyls by GC-ECD									
*Aroclor 1016	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
*Aroclor 1221	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
*Aroclor 1232	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
*Aroclor 1242	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
*Aroclor 1248	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
*Aroclor 1254	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
*Aroclor 1260	U	38.8		µg/Kg dry	1	4/23/13 14:22	4/24/13 9:37	SW 8082	BDP
DRAFT: TCLP Metals by ICP-MS									
*Arsenic	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
***Barium**	**0.0772**	0.0300		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
***Cadmium**	**0.690**	0.00600		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
*Chromium	U	0.00480		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
***Lead**	**0.508**	0.00750		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
*Mercury	U	0.000600		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
*Selenium	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC
*Silver	U	0.0150		mg/L	3	4/25/13 11:25	4/25/13 17:35	SW 6020A	JTC

DRAFT: Conventional Chemistry Parameters

LABORATORY RESULTS

Client: Flint Hills Resources
Project: TD Control Room Ex Peru, IL
Lab Order: 13D0446
Client Sample ID: DRAFT: Comp 13 E
Lab ID: 13D0446-05
Collection Date: 4/17/13 0:00
Matrix: Solid

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Prairie Analytical Systems, Inc.									
*Cyanide	U	0.297		mg/Kg dry	1	4/24/13 13:10	4/25/13 8:17	SW 9014	CCD
*Ignitability (Flash Point)	>200	50.0		°F	1	4/24/13 10:00	4/24/13 11:00	SW 1010 (M)	CCD
*Paint Filter	Pass			P/F	1	4/24/13 10:00	4/24/13 10:05	SW 9095A	CCD
***pH**	**7.0**	0.010		pH Units	1	4/23/13 12:00	4/23/13 14:22	SW 9045C	CCD
*Phenolics	U	5.93		mg/Kg dry	1	4/24/13 12:18	4/24/13 17:50	SW 9065 (M)	CCD
*Reactive Sulfide	U	9.23		mg/Kg dry	1	4/30/13 10:53	4/30/13 15:31	SW 9034	RSR
Percent Solids	**84.3**	0.100		%	1	4/23/13 15:40	4/24/13 8:15	ASTM D2216	JLS
Precision Petroleum Labs, Inc									
DRAFT:									
Extractable Organic Halides	U	1		mg/Kg	1	4/26/13 0:00	4/26/13 0:00	SW 9023	SUB

LABORATORY RESULTS

Client: Flint Hills Resources
Project: TD Control Room Ex Peru, IL **Lab Order:** 13D0446

Notes and Definitions

P1	Pass
*	NELAC certified compound.
U	Analyte not detected (i.e. less than RL or MDL).

Chain of Custody Record

Central IL - 1210 Capital Airport Drive - Springfield, IL 62707-8490 - Phone (217) 753-1148 - Facsimile (217) 753-1152
Chicago IL Office - 9114 Virginia Rd., Ste 112 - Lake in the Hills, IL 60156 - Phone (847) 651-2604 - Facsimile (847) 458-9680
Central/Southern IL Office - Phone (217) 414-7762 - Facsimile (217) 223-7922

Prairie Analytical Systems, Incorporated
www.prairieanalytical.com

Client	Flint Hills Resources
Address	501 Brunner St.
City, State, Zip Code	Peru, IL 61354
Phone / Facsimile	815-224-5451
Project Name / Number	TD Control Room ex.
Project Location	Peru, IL
P.O. # or Invoice To	
Contact Person	Michael C Schmidt

Reporting: TACO ☐ Resid ☐ Ind/Comm; CALM ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F; RISC ☐ Resid ☐ Indust

Sampler Comments:

Sample Description	Sampling Date	Sampling Time	Matrix Code	Preserv Code	No. of Containers	Sample Type Comp	Sample Type Grab	Radio Isotope	Haz Waste Profile No Pest or Herb						
Comp13 A	4/17/13		S	O	1	C		X	X						
Comp13 B	4/17/13		S	O	1	C		X	X						
Comp13 C	4/17/13		S	O	1	C		X	X						
Comp13 D	4/17/13		S	O	1	C		X	X						
Comp13 E	4/17/13		S	O	1	C		X	X						

Matrix Code	A - Aqueous	DW - Drinking Water	GW - Ground Water	NA - Non-Aqueous Liquid	S - Solid	O - Oil	X - Other (Specify)
Preserv Code	0 - None	1 - HCl	2 - H2SO4	3 - HNO3	4 - NaOH	5 - 5035 Kit	X - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
M C Schmidt	4/22/13	8:34 AM				
			[signature]	4-22-13	10:15	[signature]

Special Instructions:

Turnaround Time: Standard ☐ Rush ☒
Date Required:

QC Level 1☒ 2☐ 3☐ 4☐

On wet ice? Yes No

Temperature (°C) 1.1

Page 1 of 1

Copies: White - Client / Yellow - PAS, Inc. / Pink - Sampler

PAS COC Rev. 3

Page 13 of 13

FHRPRU001810

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

Mr. Michael Brophy
Prairie Analytical Systems, Inc.
1210 Capital Airport Drive
Springfield, Illinois 62707

LABORATORY REPORT NO:. 2000-293-01
DATE: 05-20-2013
SAMPLES RECEIVED: 04-23-2013
PURCHASE ORDER NO:

Below are the results of the analyses for gross alpha, gross beta and gamma on one sample.

Sample ID	13D0446-01
Collection Date	04-17-13
Lab Code	SPS-1930

Isotope	Concentration (pCi/g dry)	Date Analyzed	Method
Gross Alpha	6.9 ± 2.8	05-17-13	AB-01
Gross Beta	12.7 ± 2.6	05-17-13	AB-01
K-40	6.5 ± 0.5	05-03-13	901.1
Cs-137	< 0.1	05-03-13	901.1
Ti-208	0.2 ± 0.1	05-03-13	901.1
Bi-212	1.3 ± 0.4	05-03-13	901.1
Bi-214	1.2 ± 0.1	05-03-13	901.1
Pb-212	0.6 ± 0.1	05-03-13	901.1
Ra-226	1.1 ± 0.1	05-03-13	901.1
Ra-228	0.7 ± 0.1	05-03-13	901.1
Total gamma (30-2036 KeV)	17.3	05-03-13	901.1

The error given is the probable counting error at 95% confidence level. The less than value is based on 4.66 sigma counting error for the background sample.

E-mail: brophym@prairieanalytical.com
E-mail: potterk@prairieanalytical.com

Sincerely,

Bronia Grob,
Laboratory Manager

APPROVED BY 5/20/13
Tony Coorlim,
Quality Assurance

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

Mr. Michael Brophy		LABORATORY REPORT NO.	: 2000-293-02
Prairie Analytical Systems, Inc.		DATE:	05-20-2013
1210 Capital Airport Drive		SAMPLES RECEIVED:	04-23-2013
Springfield, Illinois 62707		PURCHASE ORDER NO:	

Below are the results of the analyses for gross alpha, gross beta and gamma on one sample.

Sample ID	13D0446-02
Collection Date	04-17-13
Lab Code	SPS-1932

Isotope	Concentration (pCi/g dry)	Date Analyzed	Method
Gross Alpha	7.1 ± 2.9	05-17-13	AB-01
Gross Beta	13.9 ± 2.6	05-17-13	AB-01
K-40	7.9 ± 0.7	05-03-13	901.1
Cs-137	< 0.1	05-03-13	901.1
Tl-208	0.3 ± 0.1	05-03-13	901.1
Bi-212	1.4 ± 0.4	05-03-13	901.1
Bi-214	1.4 ± 0.1	05-03-13	901.1
Pb-212	0.8 ± 0.1	05-03-13	901.1
Ra-226	1.5 ± 0.1	05-03-13	901.1
Ra-228	0.9 ± 0.1	05-03-13	901.1
Total gamma (30-2036 KeV)	**22.2**	05-03-13	901.1

The error given is the probable counting error at 95% confidence level. The less than value is based on 4.66 sigma counting error for the background sample.

Sincerely,

E-mail: brophym@prairieanalytical.com
E-mail: potterk@prairieanalytical.com

Bronia Grob,
Laboratory Manager

APPROVED BY 5/20/13
Tony Coorlim,
Quality Assurance

FHRPRU001812

ATI Environmental, Inc.
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Mr. Michael Brophy
Prairie Analytical Systems, Inc.
1210 Capital Airport Drive
Springfield, Illinois 62707

LABORATORY REPORT NO.: 2000-293-03
DATE: 05-20-2013
SAMPLES RECEIVED: 04-23-2013
PURCHASE ORDER NO:

Below are the results of the analyses for gross alpha, gross beta and gamma on one sample.

Sample ID 13D0446-03

Collection Date 04-17-13

Lab Code SPS-1933

Isotope	Concentration (pCi/g dry)	Date Analyzed	Method
Gross Alpha	< 3.5	05-17-13	AB-01
Gross Beta	8.0 ± 2.2	05-17-13	AB-01
K-40	6.6 ± 0.6	05-05-13	901.1
Cs-137	< 0.1	05-05-13	901.1
Tl-208	0.2 ± 0.1	05-05-13	901.1
Bi-212	< 0.4	05-05-13	901.1
Bi-214	1.0 ± 0.1	05-05-13	901.1
Pb-212	0.5 ± 0.1	05-05-13	901.1
Ra-226	1.0 ± 0.1	05-05-13	901.1
Ra-228	0.6 ± 0.1	05-05-13	901.1
Total gamma (30-2036 KeV)	**13.4**	05-05-13	901.1

The error given is the probable counting error at 95% confidence level. The less than value is based on 4.66 sigma counting error for the background sample.

E-mail: brophym@prairieanalytical.com
E-mail: potterk@prairieanalytical.com

Sincerely,

Bronia Grob,
Laboratory Manager

APPROVED BY 5/20/13
Tony Coorlim,
Quality Assurance

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Mr. Michael Brophy
Prairie Analytical Systems, Inc.
1210 Capital Airport Drive
Springfield, Illinois 62707

LABORATORY REPORT NO. : 2000-293-04
DATE: 05-20-2013
SAMPLES RECEIVED: 04-23-2013
PURCHASE ORDER NO:

Below are the results of the analyses for gross alpha, gross beta and gamma on one sample.

Sample ID 13D0446-04

Collection Date 04-17-13

Lab Code SPS-1934

Isotope	Concentration (pCi/g dry)	Date Analyzed	Method
Gross Alpha	11.5 ± 3.5	05-17-13	AB-01
Gross Beta	23.2 ± 2.9	05-17-13	AB-01
K-40	10.7 ± 0.7	05-05-13	901.1
Cs-137	< 0.1	05-05-13	901.1
Tl-208	0.3 ± 0.1	05-05-13	901.1
Bi-212	< 0.5	05-05-13	901.1
Bi-214	1.7 ± 0.1	05-05-13	901.1
Pb-212	0.8 ± 0.1	05-05-13	901.1
Ra-226	1.8 ± 0.1	05-05-13	901.1
Ra-228	1.0 ± 0.2	05-05-13	901.1
Total gamma (30-2036 KeV)	**25.7**	05-05-13	901.1

The error given is the probable counting error at 95% confidence level. The less than value is based on 4.66 sigma counting error for the background sample.

Sincerely,

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E-mail: potterk@prairieanalytical.com

Bronia Grob,
Laboratory Manager

APPROVED BY 5/20/13
Tony Coorlim,
Quality Assurance

FHRPRU001814

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Mr. Michael Brophy
Prairie Analytical Systems, Inc.
1210 Capital Airport Drive
Springfield, Illinois 62707

LABORATORY REPORT NO.:	2000-293-05
DATE:	05-20-2013
SAMPLES RECEIVED:	04-23-2013
PURCHASE ORDER NO:	

Below are the results of the analyses for gross alpha, gross beta and gamma on one sample.

Sample ID	13D0446-05
Collection Date	04-17-13
Lab Code	SPS-1935

Isotope	Concentration (pCi/g dry)	Date Analyzed	Method
Gross Alpha	12.1 ± 3.8	05-17-13	AB-01
Gross Beta	17.1 ± 2.7	05-17-13	AB-01
K-40	12.3 ± 1.2	05-05-13	901.1
Cs-137	< 0.1	05-05-13	901.1
Tl-208	0.3 ± 0.1	05-05-13	901.1
Bi-212	1.5 ± 0.6	05-05-13	901.1
Bi-214	2.0 ± 0.2	05-05-13	901.1
Pb-212	1.1 ± 0.1	05-05-13	901.1
Ra-226	2.1 ± 0.1	05-05-13	901.1
Ra-228	1.4 ± 0.3	05-05-13	901.1
Total gamma (60-2024 KeV)	**27.1**	05-05-13	901.1

The error given is the probable counting error at 95% confidence level. The less than value is based on 4.66 sigma counting error for the background sample.

E-mail: brophym@prairieanalytical.com
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Sincerely,

Bronia Grob,
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